Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

April, 1934

3063

Selfvulc SAVES BELTS

BEFORE

you decide to "junk" any of your old conveyor belts, *read this letter.*

THEN

save the expense of replacements by resurfacing your worn belts with SELFVULC, and make them as good as new. Even if they are worn down to the canvas, an application of this self-curing Plastic Rubber Compound will restore them to service and double their durability.

TRIAL OUTFIT

Write for information on our special offer of a *trial outfit* of SELFVULC. You can make a test in your own plant at a small outlay and prove the economy of repairing belts and lining chutes or protecting other equipment from abrasion and corrosion with SELFVULC.

Selfvulc

MOULDING-BROWNELL CORPORATION

MANUFACTURERS-PRODUCERS-DISTRIBUTORS

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PLASTERERS &
MASONS SUPPLIES
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CRUSHED STONE
AND GRAVEL
FLUXING STONE
ASPHALT SAND
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LAKE SAND
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COAL & COKE

February 5, 1934.

Self-Vulcanizing Rubber Co., Inc.,
605 W. Washington Blvd.,
Chicago, Ill.

Gentlemen:-

During the past three years that we have been using Selfvulc for repairing and resurfacing our conveyor belts, we have not had to purchase any new belts. Our expense for replacements averaged about $7,000.00 per year, but since using your material it has shown a saving of 60% to 75% per year.

We carry a stock on hand so that immediate repairs are made as worn spots appear.

Yours very truly,

MOULDING-BROWNELL CORPORATION

John T. Abbott - Ass't. Manager

MAY 1 E 1934

SELF-VULCANIZING RUBBER COMPANY, INC.
605 West Washington Boulevard
CHICAGO, ILLINOIS

Pages 19-21

Since 1929 the largest net paid A. B. C. producer circulation in the field

OVER 1,000,000 TONS

WITHOUT A CENT . . . FOR REPAIR COST

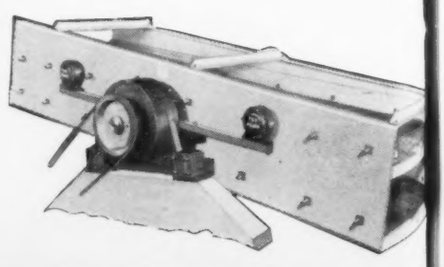
- **Over one million tons of aggregate have been accurately sized on one 4′x8′, 3-deck JIGGER Vibrating Screen—Handling 300 tons per hour. . . . *Still in best running condition.***

- ***Are you getting maximum recovery from your screening?***

No two materials screen alike. Even though they come from the same deposit they often vary from day to day.

The JIGGER—a time proven screen—has vibration to suit the material, and is the only screen that will give you maximum efficiency at all times—and thus minimum costs.

Write today for more information.



- **NAME OF PLANT ON REQUEST**

PRODUCTIVE EQUIPMENT COR

210 East Ohio Street, Chicago, Ill.

GMC

Heavy Duty Trucks

are preferred by those who *Service* them—by those who *Drive* them—by those who *Study* the *Cost Sheets*

GMC Heavy Duty Trucks are *truck-engineered and truck-built*, so as to call for as little shop work as possible. When repairs or adjustments are needed, GMC design and accessibility make them easier and quicker to do.

Drivers like GMC Heavy Duty Trucks because they have a comfortable, *livable*, GMC-built cab. Besides that, they are easy to "take down the road"—to steer—and to stop.

The man at the top, who pays the bills, likes them, because there aren't so many bills to pay.

Don't buy a heavy duty unit until you have our recommendation. That recommendation is based on 30 years of *specialization* in the manufacture and *application* of heavy duty units—of knowing how to *fit the truck to the job.*

GMC Heavy Duty Trucks come in a complete range of types and sizes, 5 to 22 tons, including tractor-trailer combinations.

11 basic models. 6 heavy duty engines—all 6-cylinder, valve-in-head, each developing the highest torque per cubic inch displacement *of any engine of its capacity.* 44 chassis selections. 14 rear axles. 7 transmissions. And all of them *regular, standard GMC heavy duty units.*

Plus 3 cab-over-engine models—7, 8 and 10-ton! GMC Super Heavy Duty units can actually be built *to your own specifications.*

Call your GMC dealer today.

GENERAL MOTORS TRUCKS and Trailers

GENERAL MOTORS TRUCK COMPANY — *Time Payments Available Through Our Own Y. M. A. C.* — PONTIAC, MICHIGAN

Pit and Quarry

With which is consolidated
CEMENT-MILL & QUARRY

Volume 26 April, 1934 Number 10

MEMBER AUDIT BUREAU OF CIRCULATIONS

Published on the first of each month for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other non-metallic minerals. Entered as second-class matter November 28, 1932, at the Postoffice at Chicago, Ill., under the Act of March 3, 1879.

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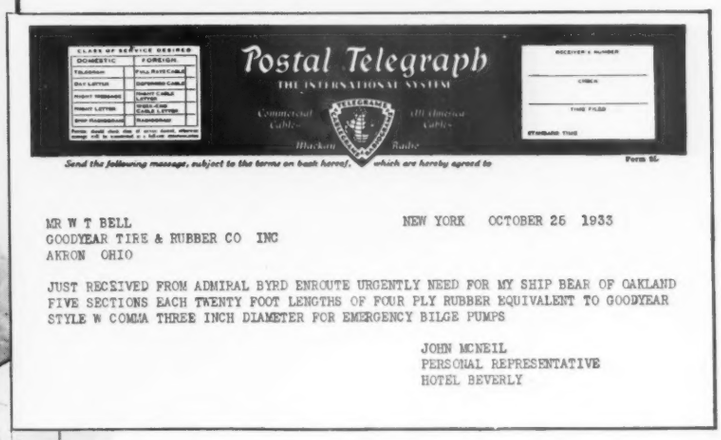
NRA MEMBER U.S. WE DO OUR PART

WITH BYRD IN POLAR SEAS!

His Supply Ship "Bear" Clears Bilge with GOODYEAR SUCTION HOSE



Postal Telegraph
THE INTERNATIONAL SYSTEM

Send the following message, subject to the terms on back hereof, which are hereby agreed to

MR W T BELL
GOODYEAR TIRE & RUBBER CO INC
AKRON OHIO

NEW YORK OCTOBER 26 1933

JUST RECEIVED FROM ADMIRAL BYRD ENROUTE URGENTLY NEED FOR MY SHIP BEAR OF OAKLAND FIVE SECTIONS EACH TWENTY FOOT LENGTHS OF FOUR PLY RUBBER EQUIVALENT TO GOODYEAR STYLE W COMMA THREE INCH DIAMETER FOR EMERGENCY BILGE PUMPS

JOHN MCNEIL
PERSONAL REPRESENTATIVE
HOTEL BEVERLY

ADMIRAL ORDERS STYLE "W"

His Own Message

Reads Like a G.T.M. Specification

Byrd and his gallant crew are down there now, alongside the great ice barrier at Bay of Whales and Little America. Only the radio binds them to kin.

Standing by also has been the Admiral's supply ship, "Bear of Oakland", equipped with another steadfast connection with safety—*Goodyear Style "W" Suction Hose.*

We speak of it very modestly in our catalog: "It will give excellent service and where it is given good care it will stand up under considerable punishment."

Evidently the Admiral weighed every word of that when he radioed his order.

YOU and the G.T.M.

Your business, too, may be exploring, these days. Certain things you can anchor to: *Quality*, scientifically produced; *Efficiency*, expertly applied.

Goodyear makes a world-recognized line of Mechanical Rubber Goods. The G. T. M.—Goodyear Technical Man—knows where these goods can operate to your advantage. Why not get your equipment problem and the G. T. M. together?

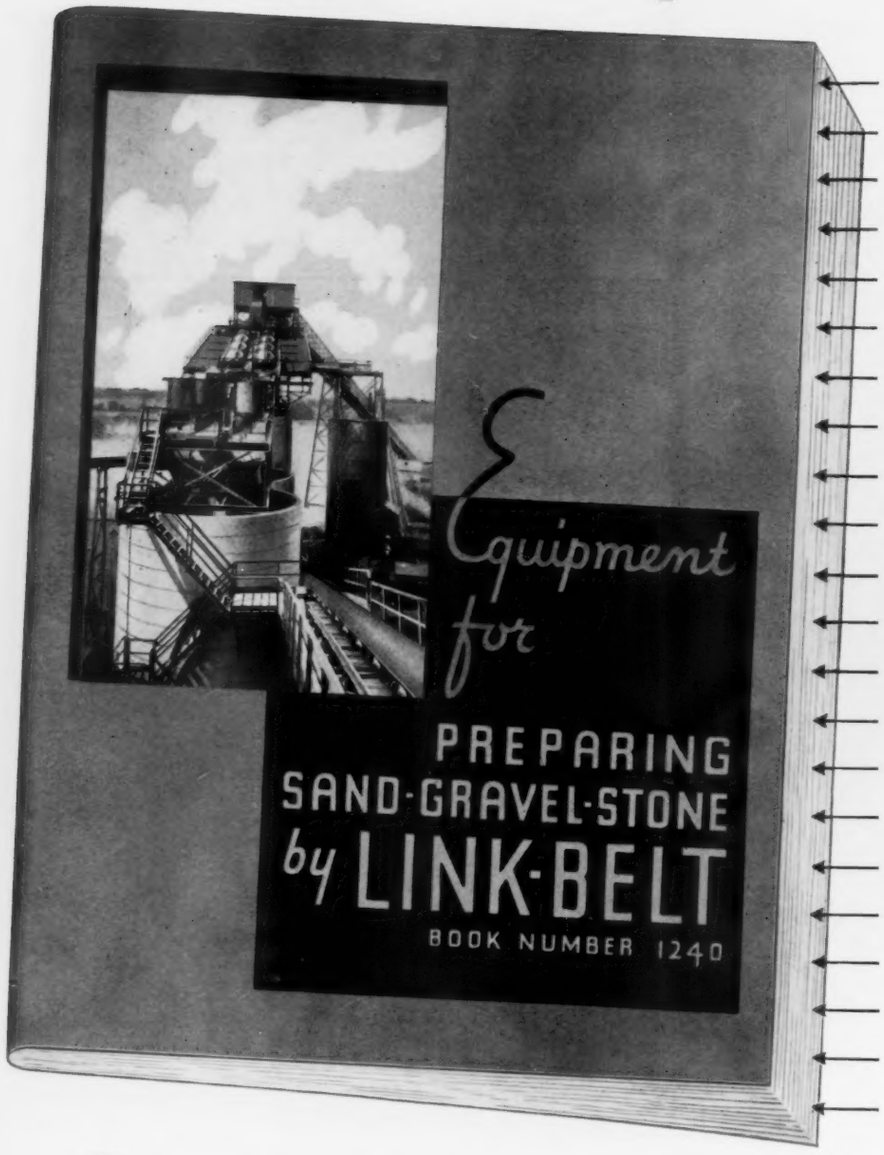
Write Goodyear, Akron, Ohio, or Los Angeles, Calif., or call your Goodyear Mechanical Goods Distributor.

BELTS • MOLDED GOODS
HOSE • PACKING
MADE BY THE MAKERS OF GOODYEAR TIRES

THE GREATEST NAME IN RUBBER

GOODYEAR

"Designed by LINK-BELT"



- The Principles of Washing and Sizing
- Complete Sand, Gravel, Stone Plants
- The Vibrating Screen
- The Conical Screen
- Scrubbing
- Log and Screw Washing
- Sand Classification and Dewatering
- Revolving Screens
- Spouts and Gates
- The Belt Conveyor
- Bucket Elevators
- Digging Elevators
- Spiral Conveyors
- Apron Conveyors
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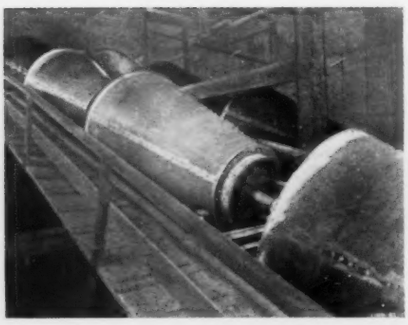
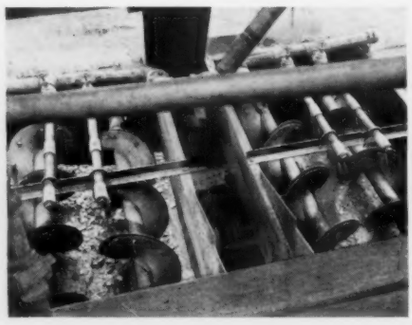
Send for this Book. Just off the press—64 pages of data and engineering information covering the whole subject of handling and preparation. A text book for the producer of sand, gravel, stone, lime and other non-metallic minerals. Send for your copy. Address nearest office.





Means STURDY CONSTRUCTION • LOW OPERATING COST

LINK-BELT SOLVES YOUR PROBLEM IN THE ENGINEERING DEPARTMENT

Link-Belt has not only brought to a high state of perfection the design of the various units entering into a complete plant, but has paid particular attention to the proper application of these units. Plant layout is all-important. Misapplication of equipment results in inefficiency, high operating costs, and an unsatisfactory product.

Let Link-Belt bring its engineering skill and experience to bear on your problem. The sole objective is to help you turn out a clean, uniform product at the lowest cost. Link-Belt manufacturers in its own shops a complete line of all types of screens, washers, conveyors, elevators, etc., and is, therefore, free to recommend the type and method that will fit the particular conditions best.

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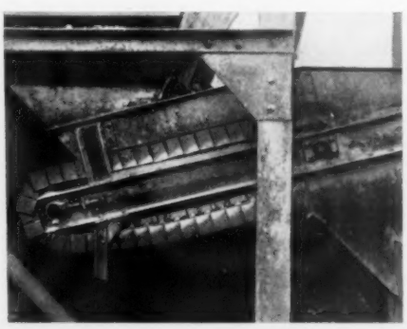
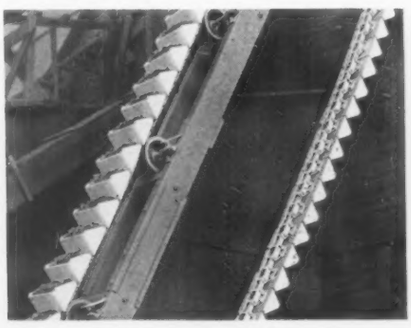
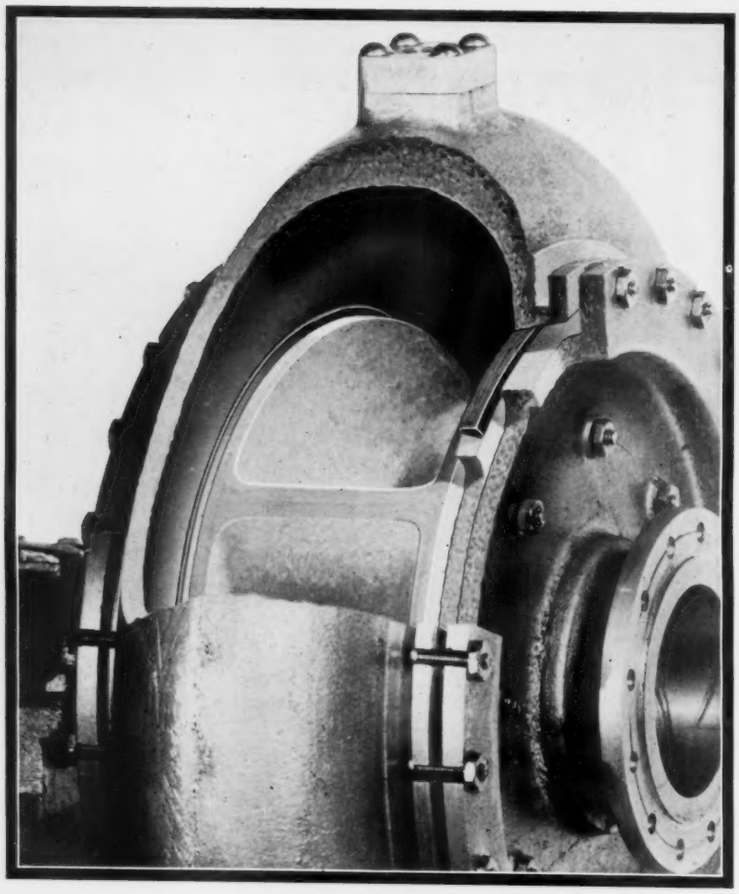
INDIANAPOLIS SAN FRANCISCO PHILADELPHIA TORONTO

Offices in Principal Cities 4915







THE NEW *Diamond* "Wear Resister" —adds to pump life

HERE'S proof of wear-ability

WABASH SAND AND GRAVEL COMPANY
WASHED—SCREENED—SIZED
300-5-7 TERRE HAUTE TRUST BUILDING

TERRE HAUTE, INDIANA
February 19, 1934.

Pettibone-Mulliken Co.,
4710 W. Division St.,
Chicago, Illinois.

Gentlemen:

I believe in giving credit where it is due, and I am therefore writing you this letter about the remarkable service we are getting from the Diamond Dredge Pump Shells we purchased from you some months ago.

Our first pump shell of this type was installed in May 1931 and produced approximately 70,000 more tons of sand and gravel than the average production of our conventional type pumps formerly used.

We attribute this marked improvement in pump life entirely to the rubber seal which protects the pump shell at the joints adjacent to the liner plates. Wear at these points is now practically negligible.

After our first experience with your shell, we decided to replace the pump shells of our old pumps with the new Diamond type and results were more than satisfactory. We are at present trying to determine the savings in power effected by your type of construction. We feel that it improves the power efficiency of the pump but just how much we are not prepared to say.

I honestly believe that your new shell incorporates the only outstanding development in dredge pumps in the past quarter century and if this letter will be of any help to you in acquainting other operators with its advantages, you may feel free to use it in any way you wish.

Yours very truly,
WABASH SAND AND GRAVEL CO.
L. F. Hart

Old timers will tell you that the big thing in dredging operations is "a good pump made of tough stuff to stand the gaff."

But Diamond Dredge Pumps go a step farther. They are not only made of the most durable material obtainable—Diamond Manganese Steel for all wearing parts—but they are also safeguarded from direct abrasion at vital points by the new WEAR RESISTER.

This advanced development is responsible for the unusual performance of Diamond Pumps. By protecting the pump shell, side plates and liners from wear, at vital points, it insures greater yardage, longer work life, fewer repairs—eliminates costly shutdowns, steps up production.

Write for details of "Diamonds." They mean more profit for you on every job, handling sand, gravel, slurry and all kinds of sludge.

NOTE: THE WEAR RESISTER IS EASILY ADAPTABLE TO YOUR PRESENT INSTALLATION. PATENT NUMBER 1947148.

PETTIBONE MULLIKEN CO.

P. M. Co. Products include Traveling Chain Cutters, Rotary Cutters, Elbows, Flap Valves, Jaw Plates, Nipples, Crusher Parts, Dippers, Dipper Teeth, Bucket Lips, Sheaves and other Manganese Steel Products.

4710 West Division Street
CHICAGO Est. 1880 ILLINOIS

From boulder popping

Two Worthington Rock Hammers, popping boulders

through
shallow ledge work
to
snake holing
and
deep hole wagon drilling

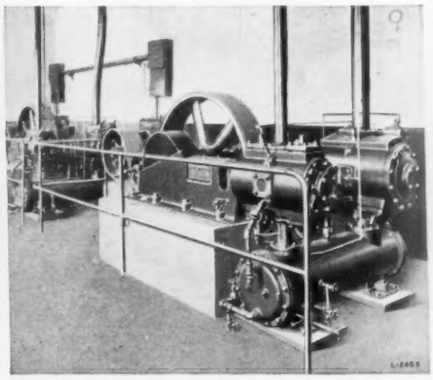
. . . there's a Worthington Rock Drill which will do the job—better • quicker • cheaper

Worthington Drifter, snake holing

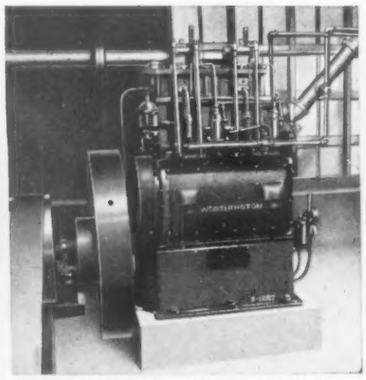
WHETHER you need a rock drill . . . a compressor to supply the air . . . or a Diesel engine to drive your crushing plant . . . ask the nearest Worthington office to send a representative to give you complete information and competent recommendations.

WORTHINGTON PUMP AND MACHINERY CORPORATION
GENERAL OFFICES: HARRISON, NEW JERSEY
Branch Offices or Representatives in Principal Cities throughout the World

Worthington Wagon Drill on deep ledge work



Worthington Duplex Compressors . . . a reliable, economical air supply



Worthington 2-cylinder Deisel Engine for driving crusher

WORTHINGTON

NRA A-3444

IF YOU WANT

AN INCREASE IN YARDAGE BLASTED

WIDER SPACING LOWER DRILLING COSTS

EASIER SHOVELLING

Do the Job with

APEX

Why Apex? Simply because the new action of Apex gives you a controlled force that moves the rock where you want it. The new action of Apex pulls more yards of material per pound of explosive, permitting increased spacing and decreased drilling.

What's more, the new Apex action gives a balanced power that causes favorable breakage and fragmentation . . . a tremendous item in making shovelling easier and more productive.

Let the Atlas representative arrange an Apex demonstration in your quarry... and convince yourself of the advantages of Apex in your own quarry.

ATLAS POWDER COMPANY

A proper explosive for every blasting requirement

WILMINGTON, DELAWARE

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BRANCH OFFICES: Allentown, Pa., Boston, Mass., Denver, Colo., Houghton, Mich., Joplin, Mo., Kansas City, Mo., Knoxville, Tenn., Memphis, Tenn., New Orleans, La., New York, N. Y., Norristown, Pa., Philadelphia, Pa., Pittsburg, Kansas, Pittsburgh, Pa., St. Louis, Mo., Tamaqua, Pa., Wilkes-Barre, Pa.

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ATLAS EXPLOSIVES

ATLAS EXPLOSIVES

YOU GET EXPERIENCE

—the wide experience of many years—if you use

KRUPP CEMENT MACHINERY

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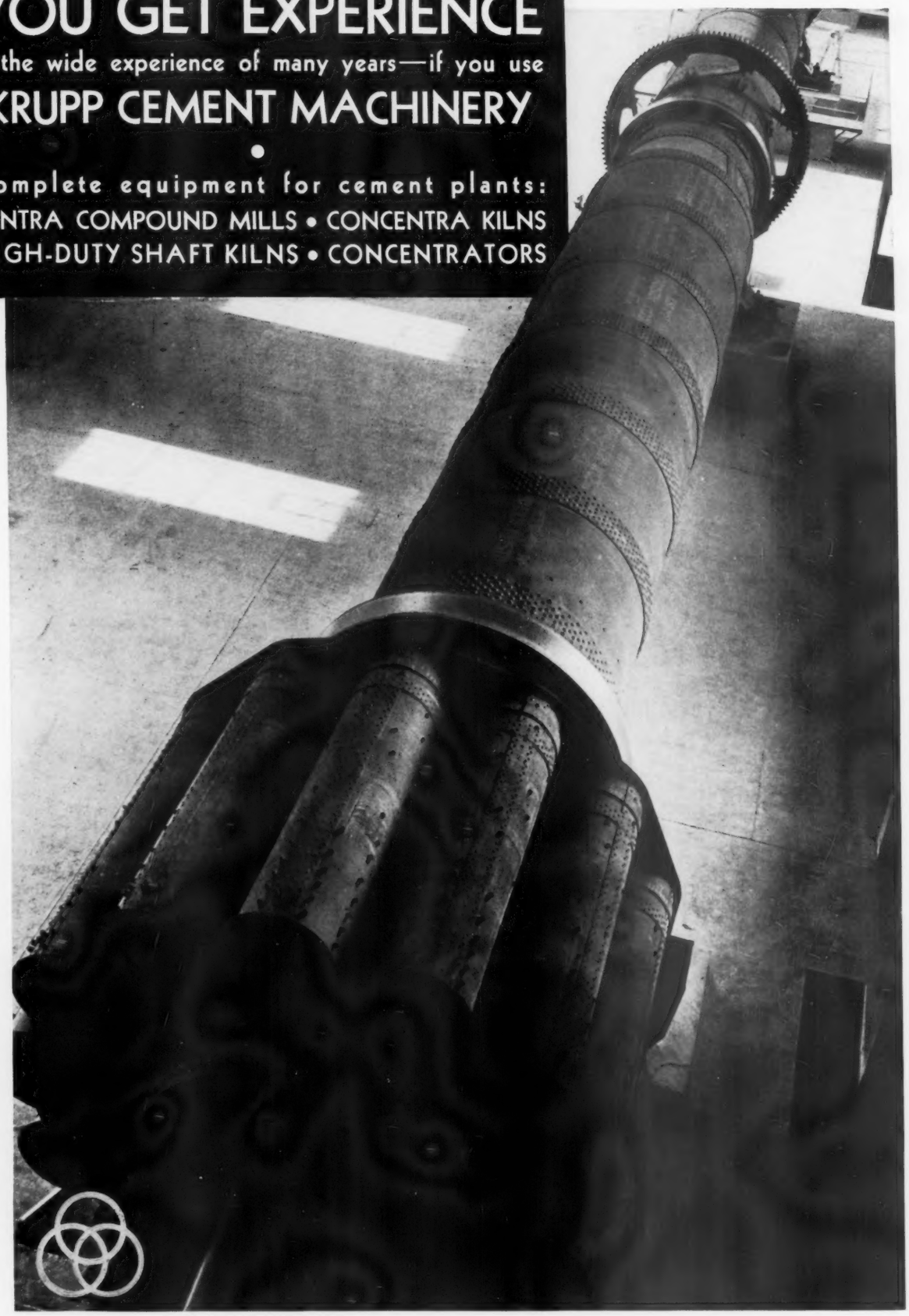
Complete equipment for cement plants:
CENTRA COMPOUND MILLS • CONCENTRA KILNS
HIGH-DUTY SHAFT KILNS • CONCENTRATORS

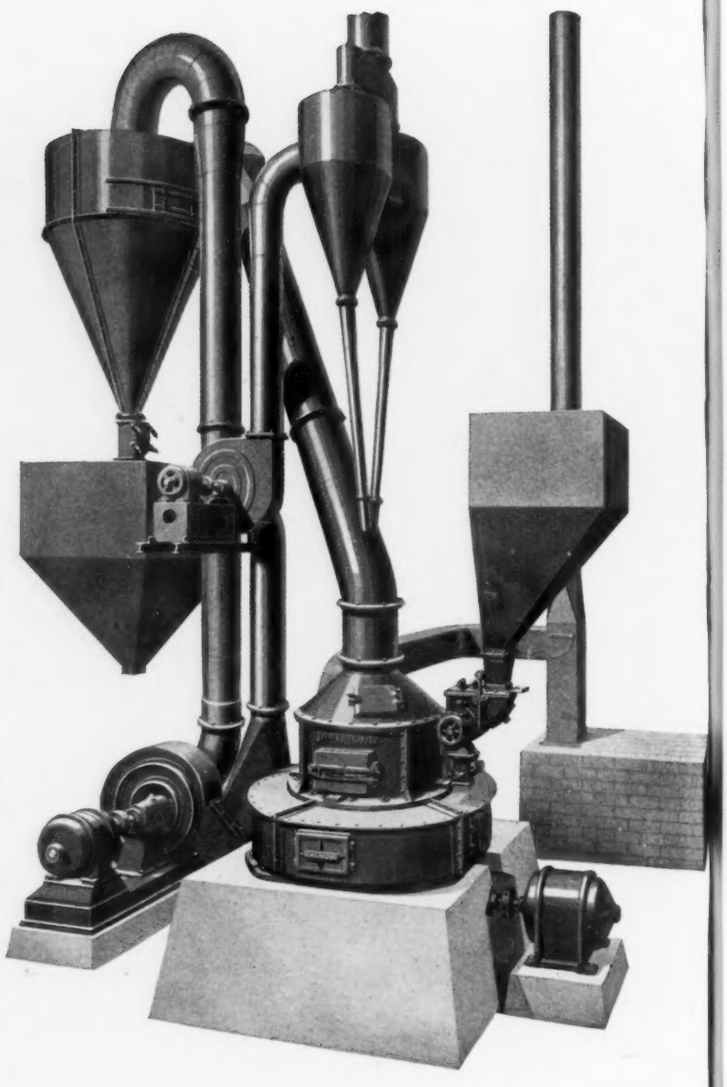


FRIED. KRUPP GRUSONWERK A.-G.

MAGDEBURG (Germany)

Representatives: THOMAS PROSSER & SON, New York, 15 Gold Street, P. O. Box 878.

GRINDING DRYING SEPARATING With ONE Mill



WHENEVER a drying problem enters into your production of powdered materials, consider the advantages of the Raymond ROLLER KILN MILL which combines DRYING with PULVERIZING and SEPARATING, all in one machine.

It insures an operating saving up to 50% or more and gives superior results, because it

Eliminates separate dryers
Shortens time of processing
Assures dustless, automatic operation
Gives close control over the product.

Limestone manufacturers say costs are cut in half by using the Kiln Mill to remove moisture while grinding.

Gypsum producers tell of increased profits and improved quality, obtained by calcining and pulverizing gypsum with the Kiln Mill.

Users of powdered fuel report that the Kiln Mill is the cheapest method of grinding coal and firing it direct to the furnaces.

If you make any kind of rock products, get the facts about the Kiln Mill—built in any capacity up to 40 tons per hour —for any fineness up to 99.9% through 400-mesh.

RAYMOND BROS. IMPACT PULVERIZER CO. Main Office and Works: 1321 North Branch Street, Chicago. Sales Offices in New York and Los Angeles.

RAYMOND

PULVERIZING, SEPARATING, AIR DRYING AND DUST COLLECTING EQUIPMENT

THE AIR ROADS ARE ALWAYS OPEN

"SKY-TRACKS" FOR BOULDER DAM

The World's Heaviest Duty Permanent Cableway—150 Ton Capacity

AMERICAN STEEL & WIRE COMPANY
The TIGER TRADE MARK is a symbol of Strength and Dependability
THE MARK FOR GENUINE AMERICAN WIRE ROPE

HIGH above the Black Canyon of the Colorado River man has stretched a slender web of steel—built "Sky-Tracks" across the abyss that for centuries seemed impassable. The Lidgerwood Cableways—essential to the completion of Boulder Dam—represent spans of from 1365 to 2575 feet. To assure maximum service and economy—they are equipped with American Steel & Wire Company Track Cables. With breaking strengths in excess of 500 tons each—they enable safe and rapid movement of materials and supplies. In connection with your own aerial transportation problem—whether it be large or small—you will find American Steel & Wire Company quality and service of exceptional value. We invite you to correspond with us.

1831 1934

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
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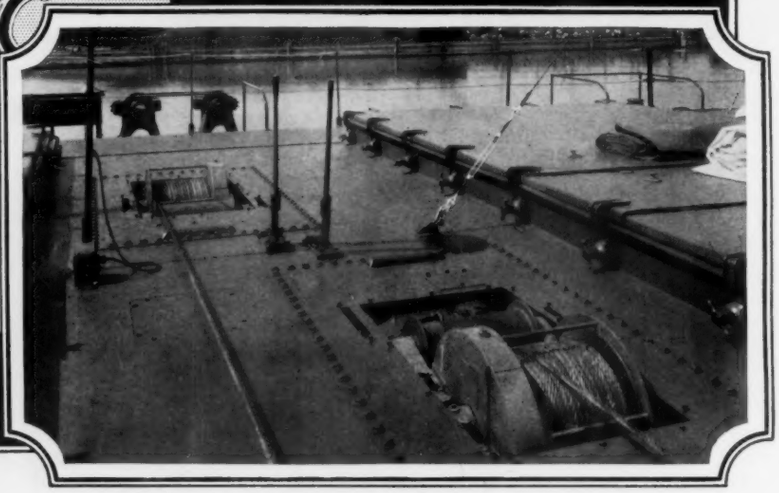

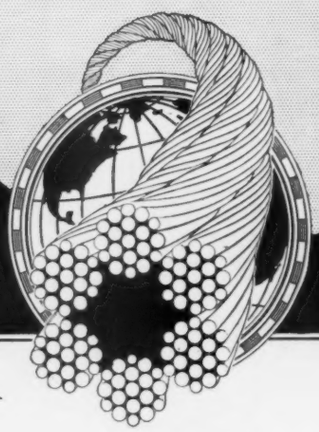

Built Right - *for Lasting Service!*

Regardless of your wire rope problems—Williamsport engineers can be of great help in their solution and you are under no obligation in consulting us.

And, too, we are producing wire rope today very much advanced in its development for specific purposes.

There's a specific wire rope for every service and it may pay you to get our advice when you are ready for your next replacement.

We are making "Form-Set"—the newest idea in preformed wire ropes. If your needs are favorable to the use of preformed wire ropes—write us.

Williamsport

WIRE ROPE COMPANY

Main Office and Works:
WILLIAMSPORT
PENNA.

Branch Sales Offices:
122 So. Michigan Ave.
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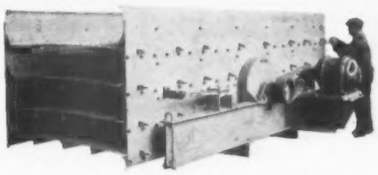
DON'T LOSE MONEY

trying to produce marketable material

WITH WORN-OUT or OBSOLETE EQUIPMENT



A GYREX SCREEN THAT MAKES SIX PRODUCTS

You know the shortcomings of your plant from experience. A little revamping may mean a lot on your profit and loss account. If you want expert advice on plant improvement, we can give it to you.

ROBINS engineers are skilled in every phase of plant layout and equipment, and we know too, that like the rest of us you want more than the best layout and a certain type of machinery. You want the best you can get for your money.

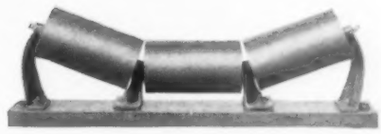
We can't tell the whole story on one page —but we have a way to tell you what you want to know. There is at your service a keen force of trained men, themselves engineers and otherwise having at their fingertips the accumulated knowledge of our 40 years of experience. They will give direct expert treatment to your particular problem.

A FEW ROBINS PRODUCTS ARE SHOWN BELOW. LET US PROVE THERE IS NOTHING BETTER AT ANY PRICE.

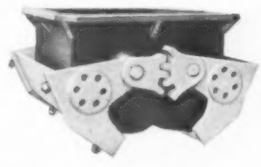
The GYREX with SUPER GYRALOY wire mesh is the most economical screen, because it is properly designed, heavily constructed, has high capacity, universal adaptability and low maintenance cost.

The VIBREX for finer screening is exceptionally popular, because of its low cost, efficient performance and reliability.

ROBINS BELT CONVEYORS with ROBINS BELTS and IDLERS are complete co-ordinated units. The Idlers have one-shot lubrication, positive seals, automatic adjustment.



ROBINS BIN GATES are sturdy and inexpensive. ROBINS also makes all other types of gates.



WE DESIGN AND BUILD COMPLETE PLANTS FOR CRUSHING, SIZING, STORING, RECLAIMING, DISTRIBUTING AND LOADING STONE, GRAVEL, SAND AND SLAG

MATERIAL HANDLING ROBINS EQUIPMENT

ROBINS CONVEYING BELT COMPANY

15 PARK ROW, NEW YORK — OLD COLONY BLDG., CHICAGO

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Two Types *of* Screens

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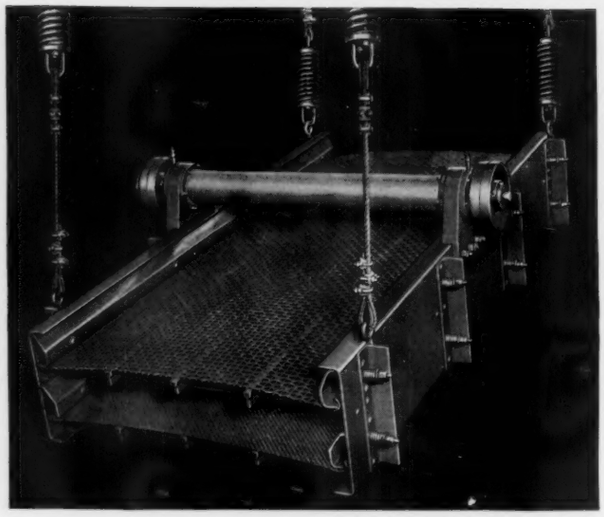
ALLIS-CHALMERS vibrating screens are available in two types . . . in sizes suitable for every plant. They are used for sizing crushed stone, slag, ore, sand and gravel, coal and coke, wood chips, commercial fertilizer, in fact, nearly all kinds of materials sized for commercial purposes, either wet or dry.

Aero-Vibe Screens

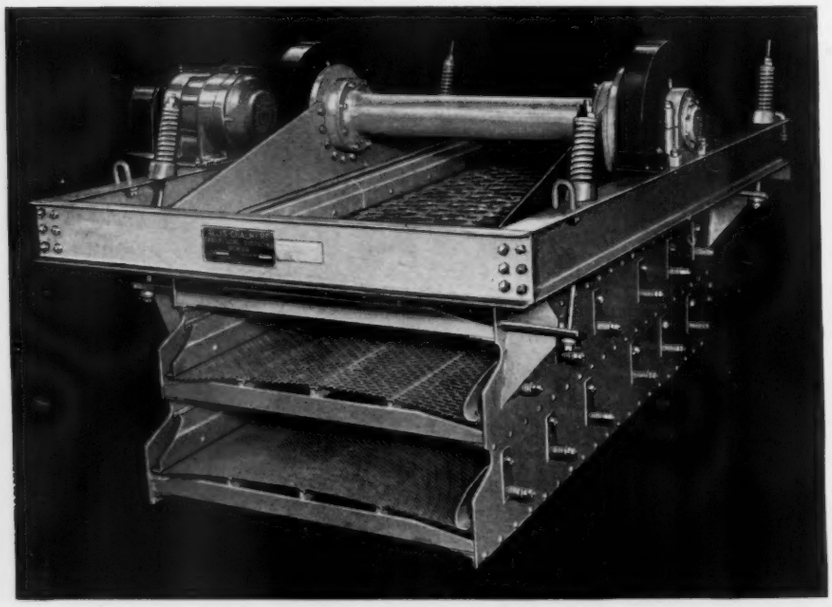
The "Aero-Vibe" screen "floats in the air" suspended from the supporting structure by cables and springs. A rapid, adjustable, vibrating motion is produced by counter-weighted wheels mounted on the drive shaft supported in anti-friction bearings above the screen body or vibrating member. Single and double deck "Aero-Vibe" screens are available from 1½ x 3 ft. to 4 x 10 ft. sizes for handling medium to fine size materials, and for limited tonnage.



Aero-Vibe Screens

Centrifugal Vibrating Screens

Style "B" Centrifugal screens are built with one, two, or three decks in sizes from 2 x 6 ft. to 5 x 14 ft. and are adaptable for heavy loads and the maximum range of material size. The screening action, which is equally intense for all tonnages, is transmitted to the Screen body or vibrating member by an eccentric shaft located above the screen and supported in anti-friction bearings. The screen body "floats" on balance springs reducing power and the load on the bearings; the entire screen is cable and spring suspended.



Style "B" Centrifugal Vibrating Screens

Crushing Plant Equipment

Gyratory Crushers
McCully and Newhouse
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Revolving Screens
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Cement Mill Machinery
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THE SPIRIT OF ACHIEVEMENT

Thermoid Products are engineered with the same spirit of achievement that has produced the world's spectacular projects.

The extra long life of Thermoid products is not a happenstance. Their ability to out-perform on the job is not accidental. Every type of Thermoid belting, hose and packing is designed and built for a life of service and a perfection of performance that engineering alone can give. The engineering for the world's greatest projects is approached with no greater zeal than Thermoid engineers give to the building of each Thermoid product.

Every product that bears the Thermoid name has been field tested! Laboratory success is *never* considered sufficient. Each item, no matter how seemingly insignificant, must have weathered a gruelling, real life test before winning its Thermoid trade-mark. *Buy by that quality mark!*

THERMOID RUBBER COMPANY

Factories and Main Offices

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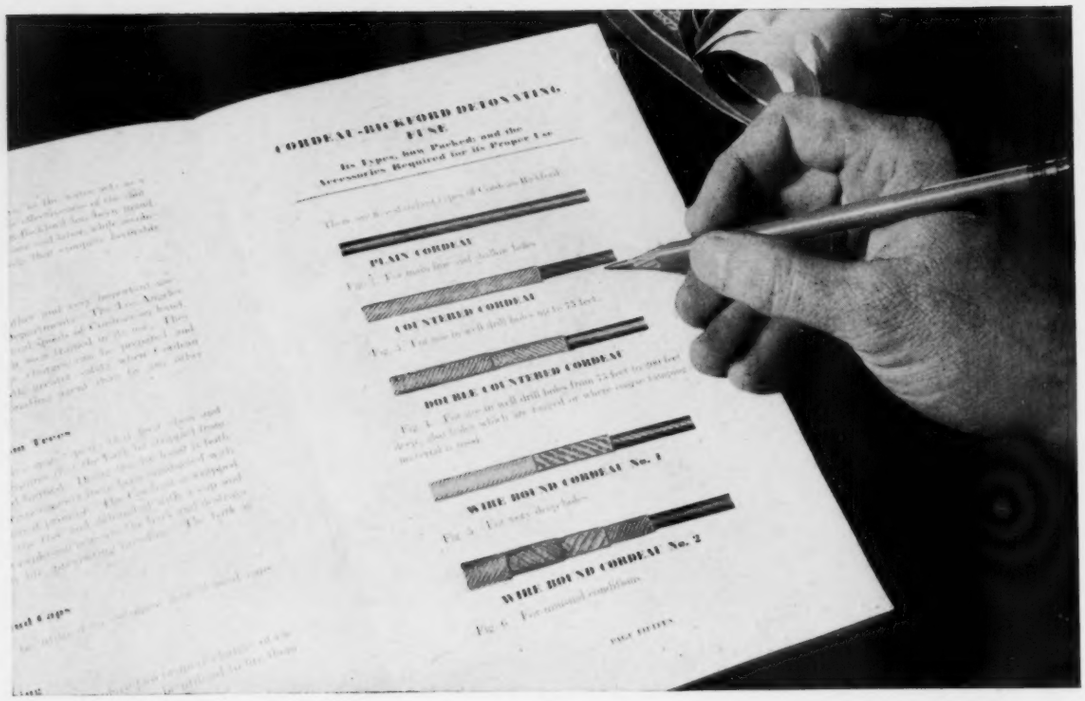
Thermoid MECHANICAL RUBBER GOODS — QUALITY VALUE SERVICE

Laying the blast for tower foundations to span the Hudson River at Bear Mountain. Photograph by Rittase.

Thermoid

BELTING
HOSE AND PACKINGS



Use the right CORDEAU *for the job*

Use Plain Cordeau for hooking up the holes above ground, and Countered Cordeau for the holes themselves. The size and depth of the hole will determine the type of Cordeau needed.

Five types are available: Plain, the lead sheath being without reinforcement; Countered, with one wrap of cotton yarn; and Double Countered. For very deep holes and other unusual conditions we recommend Wire Bound Cordeau, No. 1 or No. 2.

The proper use of Cordeau insures quicker, easier, and generally more profitable work. It is an *insensitive* detonator, and must be detonated with a fuse cap or an EB Cap. Its use simplifies loading. And because the Cordeau itself detonates *each and every* cartridge, you get *more* work from the explosives, and *better* fragmentation.

SAFETY FUSE AND LIGHTERS

Ensign-Bickford Safety Fuse is available in a number of standardized brands, each carefully made for a particular set of conditions. The use of Safety Fuse simplifies blasting technique. Send for booklet.

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There is a new technique in blasting, which brings new economies to operators everywhere. It is explained and illustrated in the Cordeau Book — free to executives.

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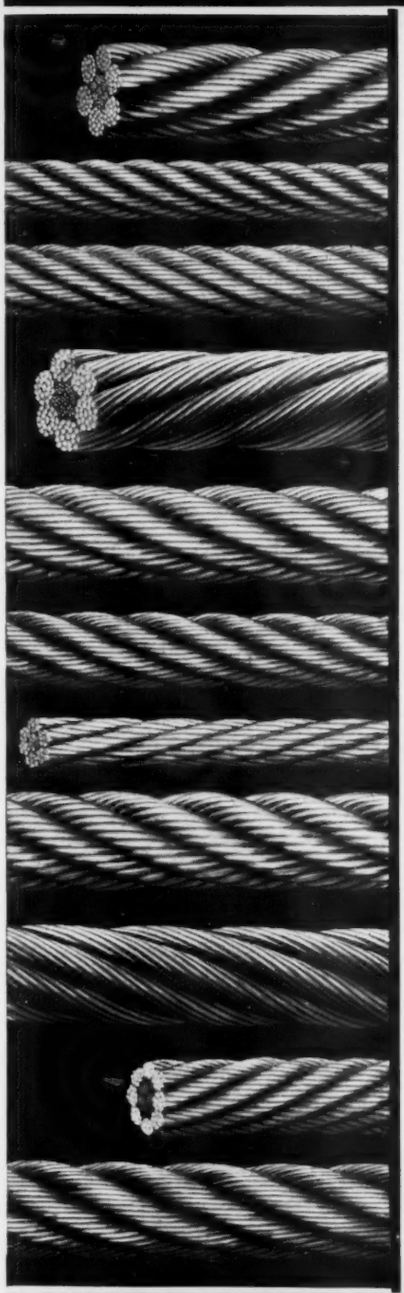
THE ENSIGN-BICKFORD COMPANY, Simsbury, Connecticut

Preformed WIRE ROPE IS NOT A LAY... BUT A MODERN PROCESS OF MANUFACTURE



LAY·SET
Preformed Wire Rope
cuts operating costs

LAY-SET is made in all sizes, grades, constructions and LAYS like ordinary wire rope. But you discover the difference when you use the first length of LAY-SET. It handles so much *easier* . . . because LAY-SET wires and strands are preformed in manufacture to the exact shape of the rope. You're handling a *relaxed* rope —seizing is no longer necessary.

In LAY-SET internal stress is eliminated. You get *full rope efficiency* on the job. Thousands of comparative service records prove this!

Preforming insures equal strand balance and reduces fatigue resulting from bending over sheaves and drums by elimination of internal stresses. LAY-SET also resists kinking and is easier to splice. Write today for complete information to

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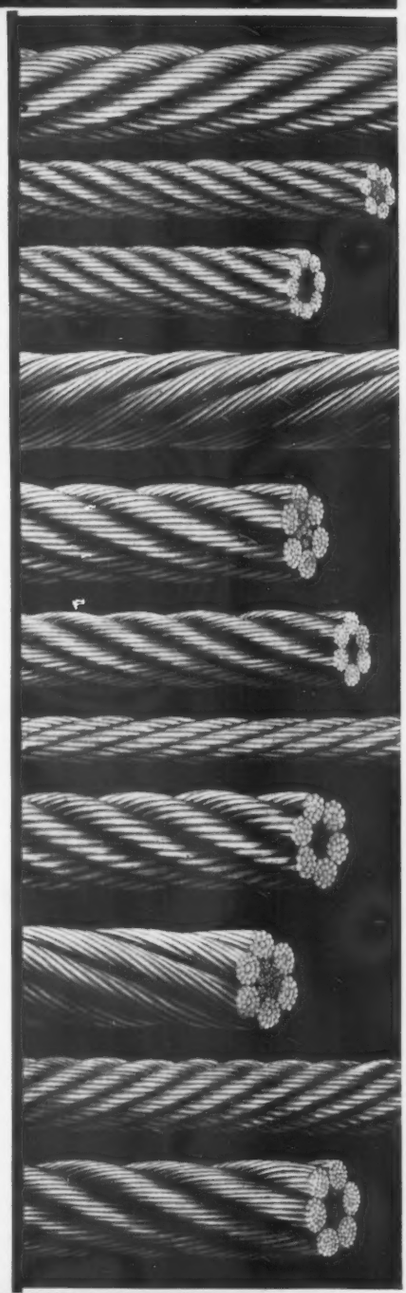

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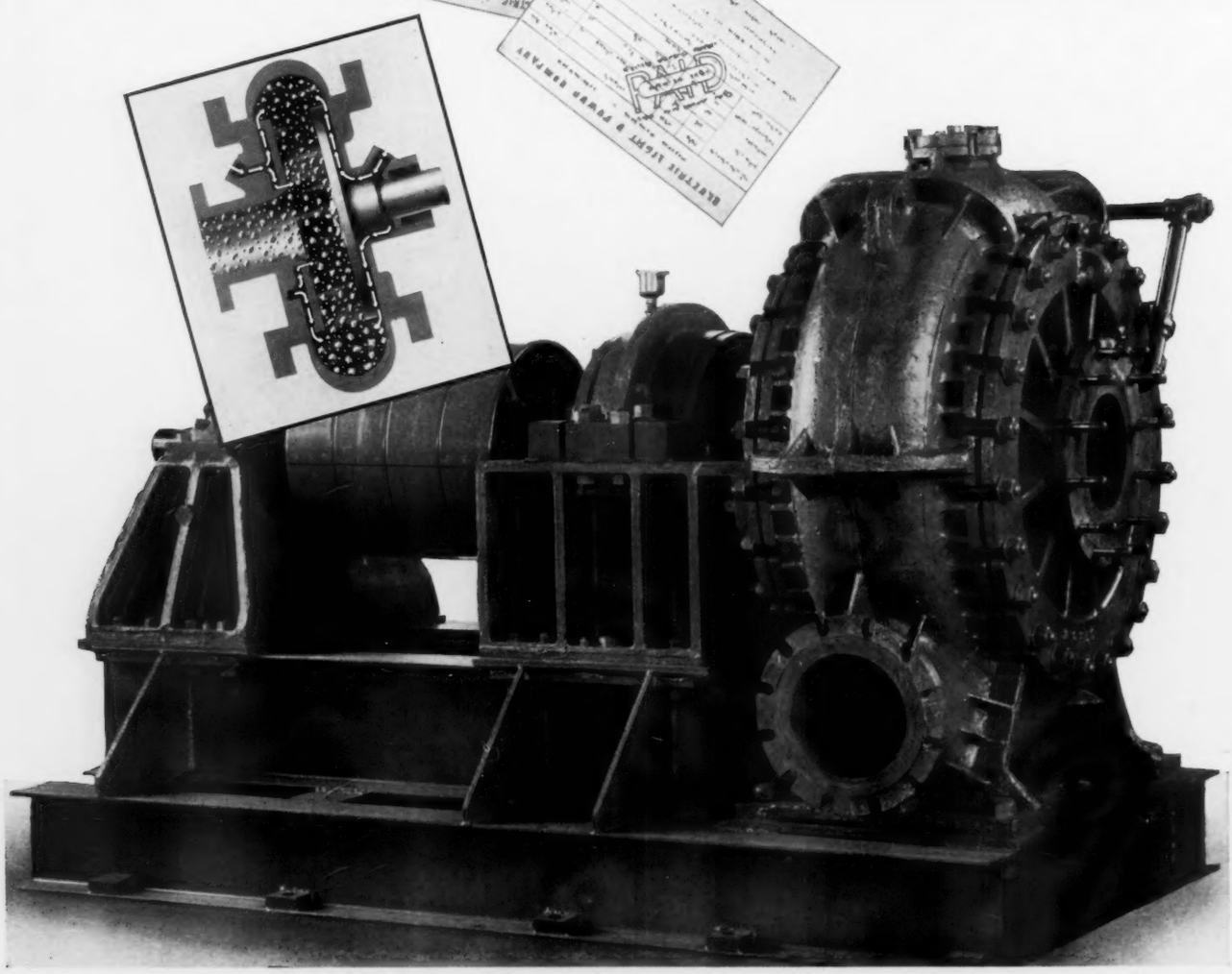
if ~ you did not have to pay every third month's Power Bill ~ ~ ~

What Would You Save

Though this sounds almost too good to be true, it is representative of the power savings usually effected by the NEW Hydroseal Dredge Pump. Prove it to yourself. If your pumps now average only 25 to 35% efficiency and you install a Hydroseal Pump with an efficiency of 50% or more,—you can do the same with about 1/3 less power . . . The Hydroseal Principle of introducing clear water on each side of the impeller (see arrows in diagram) also prevents abrasive wear between the impeller and side plates . . . Write for complete information about the NEW Hydroseal Pump, for its new improvements in design alone will convince you that it will pay for itself in a few months' time. The Allen-Sherman-Hoff Company, 223 S. 15th Street, Philadelphia. Offices in Principal Cities.

HYDRO SEAL



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MAY -9 1934

VOLUME 26 NUMBER 10

Pit and Quarry

With which is consolidated
CEMENT-MILL & QUARRY
CHICAGO, APRIL, 1934

$229,557,000 PWA Road Construction Under Way

77.8 PER CENT. OF ALLOTMENT

Progress made on the emergency construction of public-works highways to March 17 under the supervision of the U. S. Bureau of Public Roads shows that a total of 6,607 projects, estimated to cost $332,913,000, had been advertised for contract, begun by day labor employed directly by the highway authorities, or completed. The cost of the day-labor projects included in the above is estimated at $23,480,000.

Of the 5,889 projects awarded for construction, 3,911 were under construction on March 17, and 762 were completed. The work under construction, which is estimated to cost $229,557,000, was giving regular employment to 118,544 men.

In the whole country work under way and completed involved 77.8 per cent. of the $400,000,000 provided for public-works highways under Sec. 204 of the National Industrial Recovery Act.

Many Cement Plants Are Installing Recuperators

★ The Manitowoc Engineering Works, Manitowoc, Wis., some time ago installed two Vanderwerp Recuperators on 8½-ft. dry process kilns at the plant of the Kosmos Portland Cement Co., Kosmosdale, Ky. This installation and two earlier ones have been mentioned in earlier issues of PIT AND QUARRY. There are now in operation or under construction three additional installations of these recuperators in other plants, each consisting of a single unit. One of these is on a 10-ft. wet-process cement kiln; another on a 9-ft. wet-process kiln; and the third on a 10-ft. kiln being used for special purposes.

Several Changes Made in Code-Authority Personnel

Lieut.-Col. C. T. Harris has been appointed to the code authority for the cement industry, succeeding Barton W. Murray, a deputy administrator for N. R. A. Mr. Harris is one of eight army officers designated by Gen. Hugh S. Johnson as administrative members of code authorities for important industries and is one of three who succeed N. R. A. officials who have been serving temporarily. The appointees are on special duty in the office of the assistant secretary of war in connection with industrial studies.

Lieut.-Col. Harris will serve six months, or at the pleasure of Administrator Johnson. He was appointed on the recommendation of Deputy Administrator H. O. Kink and the appointment was approved by Divisional Administrator W. A. Harriman.

Gen. Johnson has approved the election of E. P. Lucas as a member of the Code Authority for the cement industry, to serve during the period of inactivity of R. B. Henderson, who at present is unable to serve because of ill health. Mr. Lucas is president of the Superior Portland Cement Co., Inc., of Seattle, Wash.

Mississippi Gravel Plant Machinery Being Installed

★ A sand and gravel plant is reported to be under construction at Robinson Jct., near Waynesboro, Miss, by O. N. Holder of Meridian, Miss. About $10,000 worth of machinery has been purchased and is now being installed.

Dakota Abandons Fourth of Five State Enterprises

After 15 years of expensive trial the state of South Dakota is abandoning another of its state-owned enterprises, a coal mine. This project is estimated to have cost the state $185,000. This leaves in existence only one of the five state business ventures. The four now defunct are the rural credit bureau, bonding department, crop hail insurance, and the coal mine. The fifth venture is the state cement plant at Rapid City which is already estimated to have cost the state over $300,000.

★ The Neal Gravel Co., Attica, Ind., has replaced two revolving screens with a Productive Equipment Corp. Jigger vibrating screen.

Cement Plants Reopen at An Increasing Rate

EXPECT HIGH MARCH OUTPUT

In response to the steadily-increasing demand for cement, due to the opening of spring construction work, cement plants which had shut down for the winter are reöpening at a rapid rate. In addition to the plants listed in recent issues the following plants have gone into operation within the past month: Superior Portland Cement Co., Concrete, Wash.; Universal Atlas Cement Co., Waco, Texas; Wabash Portland Cement Co., Osborn, O.; Wolverine Portland Cement Co., Coldwater, Mich.; Beaver Portland Cement Co., Gold Hill, Ore.; Consolidated Cement Corp., Fredonia, Kan.; Signal Mountain Cement Co., Chattanooga, Tenn.; Pennsylvania-Dixie Cement Corp., Richard City, Tenn.; International Cement Corp., Hudson, N. Y. It is also reported that the plants of the Federal Portland Cement Co., Buffalo, N. Y., and the Petoskey Portland Cement Co., Petoskey, Mich., will go into operation early in April. The Universal-Atlas Cement Co. recently increased the production of its plant at Hannibal, Mo., 50 per cent.

California Gravel Plant Additions Double Output

★ The Mirabel Gravel Co., Santa Rosa, Cal., has completed improvements which have more than doubled the capacity of its plant. These improvements included the construction of a new bin and the installation of new screens and a complete loading system.

Southwestern Obtains Large Cement Contract

The Southwestern Portland Cement Co., El Paso, Texas, according to W. R. Blair, sales manager, has obtained a contract for 300,000 sacks of cement for the construction of the Red Bluffs dam near Pecos, Tex. H. E. Nichols, plant manager, is quoted as stating that this order, with others received, will necessitate the addition of 100 men to the plant force and will keep the plant busy until late in the year.

Contractors for U. S. Must Obey N.R.A. Code

ADMINISTRATOR GIVEN POWER

President Roosevelt on March 15 tightened up the regulations requiring that all contractors dealing with the government comply with the N.R.A. codes of fair competition. In an executive order he placed full authority in the hands of the industrial recovery administrator to deal with government contractors. The order also requires that all contracts and purchase orders authorized by any state, municipal corporation, local subdivision, person or corporation "in connection with projects carried out or to be carried out, wholly or in part, with funds loaned or granted by any agency of the United States," should come under the provisions of the N.R.A. order.

The industrial recovery administrator was given power to make exceptions in specific cases. Briefly the order stipulates that all bidders must certify that they are complying with industrial codes or the blanket code. A maximum fine of $500 and sentence of six months' imprisonment were provided as a penalty for false certification.

New Barium Plant in Operation in California

★ The Pacific Minerals Co. recently put into operation a new $20,000 barium plant near Barstow, Cal. Development of other deposits in that district is said to be under way.

Announce T. V. A. Awards for Wheeler Dam Plant

★ The successful bidders on equipment for the T. V. A. aggregate plant at Joe Wheeler Dam, Tenn., are: Clyde Iron Works, Duluth, Minn, 6 gantries and cranes; American Hoist & Derrick Co., St. Paul, Minn., 4 whirley cranes; Fuller Co., Catasauqua, Pa., cement-pumping systems; Blaw-Knox Co., Pittsburgh, Pa., conveyors, bins, batchers, tanks, etc.; Ingles Iron Works, Birmingham, Ala., 4 steel barges; Norris K. Davis, Inc., San Francisco, Cal., 4 tilting concrete mixers. These awards totalled more than $290,000.00.

Tennessee Producer to Build Fine Sand Plant

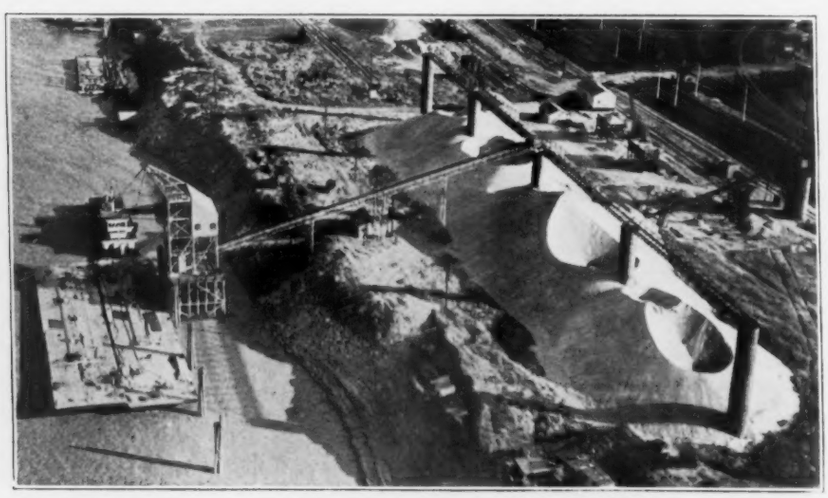
★ The Dixie Sand & Gravel Co., Chattanooga, Tenn., is reported to be erecting a new plant for the production of special fine sand.

Plan to Develop Pigment Deposits in Saskatchewan

Organization work toward the formation of a company to develop some of the most valuable deposits of iron oxides and ochres in the world, is now well under way at Regina, Saskatchewan. Mr. Charles H. Cook, formerly secretary of the Board of Trade, Regina, is secretary of the company and announces that the firm has purchased all of the natural color deposits in the province of Saskatchewan and will manufacture these into paints, alabastines and a domestic cleanser. The firm will operate a temporary plant in Regina, while plans are being made for the construction of the big plant at Riverhurst, close to the main deposits, where natural gas is cheap and plentiful. There are millions of tons of red, brown, blue, white, cream, grey and pink iron oxides in Saskatchewan.

★ The Manhattan Rubber Mfg. Co., Passaic, N. J., is supplying two long conveyor belts for the T. V. A. crushed-stone plant at Cove Creek, Tenn.

★ Frank Nicholson is reported to be installing a stone-crushing plant near Columbia, Tenn., to fill a contract for material for state projects.



Sand handling and storage plant of the St. Louis Material & Supply Co., St. Louis, Mo. Unloading dock at left, loading facilities at extreme right.

Contract Awards Show Sharp Gain in March

PRIVATE CONSTRUCTION GAINS

Contracts awarded for all classes of construction in the 37 states east of the Rockies during the initial half of March reached a total within 4 per cent. of the volume reported during the entire month of February, according to figures of F. W. Dodge Corp. Construction awards in the first 15 days of March, totaling $92,521,800 were larger, also by 55 per cent. than the total reported for the entire month of March, 1933. Although the increases over last year were due chiefly to larger government undertakings, the Dodge Bulletin indicates a moderate gain in privately-financed construction projects as well.

February awards for construction of all descriptions in the 37 eastern states totaled $96,716,300 as against $186,463,700 for January and $52,712,300 for February, 1933. February awards were 83 per cent. larger than those registered in February, 1933. Gains over last year were shown for each of the four major classifications: residential building; non-residential building; public works; and public utilities. Likewise, increases were shown both as respects public-financed construction and privately-financed work. This latter item registered a gain also as contrasted with January for this year; but publicly-financed awards showed a recession of 59 per cent. from January.

Contracts for construction of all types showed gains over February, 1933, in each of the 13 Dodge districts, except the Metropolitan Area of New York, Upstate New York and Texas districts. For the initial two months of 1934 contracts were larger than in the corresponding period of 1933 in each of the 13 districts except the Metropolitan Area of New York, Upstate New York, New Orleans and Texas territories.

Contemplated construction reported in February totaled $436,417,500 as against $475,894,600 in January and only $114,185,900 in February, 1933. Gains over last year in newly-planned construction were shown in each of the four major classes of work. Increases likewise were well distributed geographically.

★ The Koch Sand & Gravel Co., Mt. Vernon, Ind., according to H. H. Sarlls, plant manager, is completing a general repair and improvement program at its plant there.

★ Building Products, Ltd., Verona, Ont., has put into operation a new mill for the manufacture of rock granules for surfacing asphalt shingles.

★ The Tractor City Sand & Gravel Co., Janesville, Wis., has installed an American Sealdrock aggregate bituminizing plant.

Present Code Addition for Floating Equipment

SCHEDULES WAGE, HOUR LIMITS

A schedule of minimum wages and maximum hours for employees working as crews on floating equipment engaged solely in dredging and transporting sand, gravel and slag on navigable waters throughout the country, was presented to the National Recovery Act Board March 21 by Otho M. Graves, chairman of the industry's Code Authority.

The presentation of the schedule, which is to be incorporated in the code approved by President Roosevelt Nov. 10, last, was made during hearings before Deputy Administrator C. L. Hickling.

The proposed schedule establishes a 12-hr. day and a 6-day week, for the industry's employees working on floating equipment, except for watchmen living on such equipment, who have no specified maximum hours of work. Wages range from $43.75 to $70.00 per month for employees living on floating equipment, and from $62.50 to $100.00 per month for employees not provided with subsistence and quarters.

Vigorous opposition to the new schedule was made by Leo J. Ford of Pittsburgh, Pa., on behalf of certain longshoremen's unions in that city and in Huntington, W. Va., and by C. W. Deal of the International Seamen's Union of America.

Mr. Ford would establish an 8-hr. day and a 5-day week for the industry's employees engaged in work on barges, diggers, dredges, scows, and tow boats. He told the Administrator that watchmen should be paid at a rate not less than $6 a night of 8 hrs., and other employees should not receive less than $150 a month with subsistence and quarters, and $180 a month without such housing facilities. He said that the housing facilities on floating equipment should not be given much consideration, since employees do not desire to live in such conditions, and are deprived of necessary recreation by reason of them. He asked that labor be permitted to get together with industry and work out equitable working arrangements.

Mr. Deal flatly asserted that the proposed code, if carried into other industries would have the ultimate effect of wiping out the shipping codes. If every industry which operates water equipment is permitted to make its own separate code for such equipment, he said, there can be no harmony in shipping. The sand-and-gravel and slag industries should first get together with the shipping industry before attempting to work out a code for their water equipment so that the result will harmonize with what already has been done on shipping codes, he declared.

The schedule submitted by Mr. Graves proposed that:

1. In the states of Alabama, Florida, Georgia, Mississippi and South Carolina the minimum rates of pay shall range from $43.75 per month with subsistence and quarters to $62.50 per month without subsistence and quarters.

2. In Arizona, Arkansas, Kentucky, Louisiana, New Mexico, North Carolina, Oklahoma, Tennessee, Texas, Virginia and West Virginia (east) they shall range from $52.50 per month with subsistence and quarters to $75.00 —without subsistence and quarters.

3. The pay rate with and without subsistence and quarters in the states of California, Colorado, Connecticut, District of Columbia, Delaware, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Dakota, Ohio (including all operations on Ohio River), Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, West Virginia (west), Wisconsin and Wyoming would range under the schedule from $70 to $100 per month.

Explaining the minimum-wage provisions of the schedule, Mr. Graves declared that this section provides for minimum wages for watchmen of barges and scows which are essentially in conformity with the basic code. "In the case of watchmen not living aboard such vessels the provisions are identical," he said. "Labor conditions for such watchmen are similar to those of watchmen at land plants, and the same consideration which led to the establishment of the minimum wage in the basic code should govern here.

"In the case of watchmen housed aboard barges, which represent about 92 per cent. of such employees, a reasonable deduction for housing of $2.50 per week is provided. This provides for a net cash wage of something more than $45 to $50 per month, depending on the locality, which will represent a definite increase in minimum wages, and the lower wage limit is applicable to practically none of these employees, since this method of operation is not used in the lower-wage area. During 133 40 per cent. of the employees identified as watchmen aboard barges received less than $40 per month, according to returns from a questionnaire.

"Statements from companies operating approximately 75 per cent. of all the barges in our industries and housing the watchmen aboard them indicate that the proposed minimum wage is 30 to 40 per cent. above that paid in 1933," continued Mr. Graves. "They emphasize the statement that to increase this proposed minimum would lead to further unemployment by necessitating changes in the method of operation. That is, barges would be operated in fleets, with one man in charge."

The wages for employees other than watchmen were described by Mr. Graves as "fair and reasonable, and, in general, a substantial increase over the practice of the past two years."

Mr. Ford took exception to this testimony, declaring that information which he had received from rivermen on the inland rivers is that the wage schedule proposed by the Code Authority would cause reduction of from $30 to $40 a month in the wages of most river employees, and will, no doubt, result in labor trouble if permitted to become effective.

Huron Packhouse at New Storage Plant Under Way

★ The Huron Portland Cement Co. has started construction of a pack house near its storage plant at Oswego, N. Y., which was completed last fall. Equipment includes a Bates packing machine and provisions are being made for both car and truck loading.

Subdivision Development by Indianapolis Producer

The American Aggregates Corp., one of the largest producers of sand and gravel in the country, is reported to be undertaking a unique suburban development on its property at Indianapolis, Ind. This project includes the creation of an artificial lake with home sites on its shores. Dredging of the lake, which will have an area of 15 acres, is under way and will be completed in May. The lake will have a depth of from 35 to 40 ft. and its banks will slope from 10 to 20 ft. and will be landscaped, seeded and planted with trees and shrubs. A modern 8-room brick home is now under construction at the north end of the lake for Chesleigh Gray, district manager for the company. This project was begun last fall and enabled the company to keep its men at work during the usually slack winter season.

Superior Cement Co. Buys River Dock and Property

It is reported that the Superior Cement Corp., Superior, O., has taken over the Sarah Furnace property of the American Rolling Mills Co. and their river loading dock at Ironton, O., which is valued at about $100,000. It is said that a large warehouse will be erected on the site at an early date.

★ The Lehigh Portland Cement Co., Mason City, Ia., is reported to be carrying out extensions and improvements to its plant there, including electrification of a number of operating units.

★ The Canadian Aggregates, Ltd., Burford, Ont., has purchased a 7-ft. 4-cone Allswede scrubber which is being made by Watrous, Ltd.

Editorial

Labor Disputes and the N. R. A.

THERE is a growing tendency to attribute the prevalence of labor disputes to the National Industrial Recovery Act. However illogical this may on examination appear to be, it is a natural result of the disproportionate prominence given to certain phases of those disputes by most big-city newspapers and to the fact that the act itself, through the provisions of Section 7 A, has brought to the attention of a wider public the principle of collective bargaining. Although labor's insistence upon the acceptance of collective bargaining has long been known to employers, to the general public it represents something in the nature of a novelty which seems to have sprung into being with the passage of that act. Certainly the law has given not only moral but also legal sanction to the principle by making its acceptance and application by employers mandatory. To the coercive power exercised by trade unions has been added the threat of legal compulsion through either federal prosecution or—a method that is even more feared—federal licensing.

We must not be astonished if the number of labor disputes centering on the collective-bargaining principle should increase, since all the underlying causes and all the tendencies of the period lead in that direction. Labor's demand for the recognition of trade unions certainly can not be expected to weaken now that federal law has added the force of its support, and for the same reason the opposition of employers may be expected to grow as the instruments of coercion increase in effectiveness. Unless the situation is accepted, at least in the spirit of adjustment to the emergencies of the times, the issue may be forced into the field of violent decision, where strikes and lockouts are the accredited means of warfare, or into the field of judicial decision, where the result may with a reasonable degree of certainty already be predicted.

As it is hardly to be believed that the administration would have embarked on a program of social legislation so farreaching in its scope without having obtained the very highest legal opinions on its constitutionality—even the opinions of some of those who may be called upon to determine that question, should it be raised—Supreme Court approval of all the National Industrial Recovery Act's provisions respecting the relations between employers and workers may be accepted as a foregone conclusion. The more dangerous method of adjustment—the use of the usual weapons of industrial warfare—is not likely to be resorted to unless, on the one hand, the N. R. A. fails to obtain by persuasion the conformity which it can compel by law, or, on the other hand, employers refuse to accede with at least a show of willingness. Failure to act promptly on the part of the N. R. A., no less than failure to act promptly on the part of employers, is almost certain to precipitate industrial conflicts of dangerous proportions.

The question of collective bargaining involves the deeper question of trade-union recognition which is the point on which there is greatest divergence of opinion. To many employers the recovery act's demand that they deal with representatives of the workers' own choosing means recognition of existing trade-union organizations, particularly the American Federation of Labor. Other employers, especially those who have instituted or who are familiar with the theory of company unions, feel that this form of employee representation should meet the demands of all workers, whether or not they may be, or may intend to become, affiliated with existing labor organizations. The general public, together with that majority of employers who share the public's ignorance of such matters, probably wonders how there can be such differences of opinions on subjects which to it appear to be of relatively little consequence.

UNFORTUNATELY there is a very limited understanding on the part of the average person of the aims of employers and workers. He witnesses what appears to him to be a continual conflict of ideas, the resulting cost of which he is forced to bear in the form of higher prices year after year. It undoubtedly seems unpardonable to him that the two groups can not compose their differences, especially with some regard to his interests, and bring peace where strife seems to be unending. It does not occur to him that his interests, that is to say, the consumer's interests, are generally of no concern—or, at best, of very little concern—to either party to the conflict. Labor disputes do not come into being, neither are they settled, on account of any respect for or concern about public interest. Except occasionally in cases of adjustment by arbitration, the question of public policy or general good is never raised and is not considered to be within the purview of either employers or workers. In fact, a display of interest in the merits of the conflict on the part of anyone not immediately interested as a party to it is looked upon by both sides as an impertinent intrusion. An effort may be made to enlist public sympathy for one side or the other, but this usually happens, for instance, when there appears to be some danger that public sentiment, if it should chance to lie on or lean toward the side of labor, may have an adverse effect on the sale of goods. As these occasions are quite rare, there can not be said to be any widespread effort on the part of either employers or workers to inform the public of the facts or

the principles involved, much less of their respective attitudes toward them. Indeed, since, in the very nature of things, the conflicting motives that lead to industrial conflicts are almost always selfish motives, neither party to such conflicts can hope to win much public sympathy by providing an analysis of them for public consumption.

IT is for this reason that the public knows so little of the principle of collective bargaining and even less of the company-union and other employe-representation programs which some large employers in key industries have adopted. A company-union is in its conception a program of employee representation set up by an employer as a substitute for a union set up by the workers. Its aim is the provision of some form of representation for collective bargaining that will satisfy the wants of the workers without recognizing trade unions. The plans in use vary widely, as is to be expected, and they meet in varying degrees the needs of the different situations encountered. Several years ago it was said that approximately 1,500,000 workers, employed in about a thousand establishments, were represented through company unions or some similar type of organization.

This extensive development of the company-union idea was due very largely to the workers' dissatisfaction with the structure of trade unions, which, as exemplified by those affiliated with the American Federation of Labor, have been founded on the craft plan and are therefore not ideally suited to those industries in which craftsmanship no longer plays a prominent part. To the extent that company-unions have prevented the organization of workers into trade unions they have been found effective in furthering the aims of employers and have won acceptance among them.

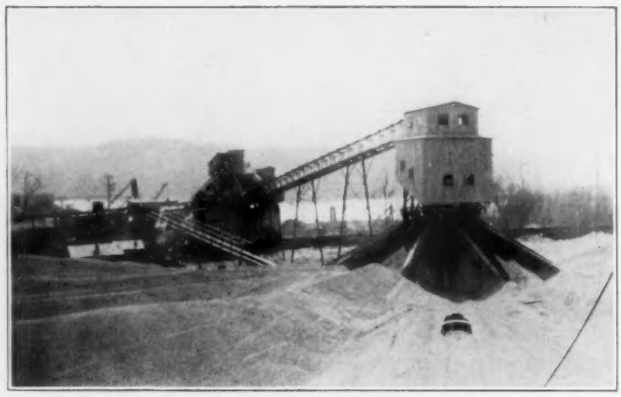
From the workers' point of view company unions have certain inherent defects. The political and social programs advocated by trade unions are beyond the reach of company unions which, as they include only the workers of a single plant or the plants of a single employer, can not engage in nationwide activities. The same limitations prevent them from increasing their memberships and from winning unprogressive employers to the adoption of the standards of the most progressive ones. Employee representatives under company-union plans have no special skill in managing or bargaining and for that reason are not as effective in improving the working conditions and earnings of those they represent as are the specially-trained traders of outside unions. Being employees of the company they are not likely to have the same freedom of action, nor are they likely to be as forceful in pressing their demands, as those who do not fear dismissal by the employers and are accountable only to the workers. The ability of trade unions, because of their national sources of income, to employ expert technical and legal aid has been advanced as an important reason for workers' preferring outside to inside labor organizations. When differences reach the point of necessitating strike action, company-union members find themselves at a disadvantage in their lack of leaders, of strike funds, and of sympathetic moral support from workers in other unions elsewhere.

The National Industrial Recovery Act has not created the theory of collective bargaining; neither has it created the issue on which most present-day labor disputes are based. Some employers and most workers have long recognized the advantages of narrowing the differences between the bargaining power possessed by both sides. In the employer group some have succeeded in accomplishing something in this direction by instigating company unions and similar contrivances, which despite their defects have improved the relations between employer and worker and have in some cases bettered working conditions. In the worker group the organized elements have had the advantages which come from concerted and well-directed effort. The recovery act aims merely to make these advantages available to employers and workers everywhere, not only by improving the situation of those who have not practiced collective bargaining but also by lessening the competitive effects of individual bargaining on those employers and workers who have been dealing collectively.

We are in a period of improving business brought about very largely by the increased purchasing power made possible by the wage and hour provisions of the recovery act and by the mounting confidence of a people who are becoming more and more convinced of the soundness of the administration's economic policies. But we must expect to bear some of the penalties of such a period. One of these is an increasing number of labor disputes. As purchasing power increases and the sales of all kinds of commodities, raw-material and manufactured, rise, labor will seek to obtain an increasingly large share of the gains, just as in the period of declining business it was forced to accept a continuously decreasing share. In both periods the claims of labor are more numerous than in times of steady business; when business improves, labor seeks increases; when it declines, labor seeks to prevent decreases.

AS members of the general public, which is not directly concerned in many of the disputes that go on about us but which nevertheless carries the major share of the financial burden, we must consider carefully the long-term effects of the principles which are so often brought into these controversies. The increasing long-term prosperity of this country has been attributed to the high actual wages paid to American labor. High actual wages mean high purchasing power, and high purchasing power means large sales and greater profits. Collective bargaining has been a great factor in raising real wages in this country and now that its adoption on a national scale is assured by law we may expect its elevating effects on purchasing power to be even greater. As we all prosper in proportion to the development of national income, we can not afford to remain uninterested or inactive in the plans for increasing it.

Hydraulic dredge with intake at left and, at right, surge-box which wastes excess fines.



Screening-and-storage tower with loading and unloading facilities in background.

Missouri Gravel Plant Uses Hydraulic Dredge of Very Large Capacity

Single Diesel Engine Operates Pump and Other Dredge Equipment

By W. E. TRAUFEER

AT Jedburg, Mo., is one of the most important sand-and-gravel plants built in this country in recent years. It is owned by the Missouri Portland Cement Co. and was reconstructed in 1931. This plant has a capacity up to 500 tons per hour. Credit for its economy of operation is given mainly to the modern new dredge and to the tower system used for the storage and reclamation of the finished product. One of the chief advantages in the design of this plant is the arrangement by which the production and shipping facilities are kept entirely separate and independent of each other.

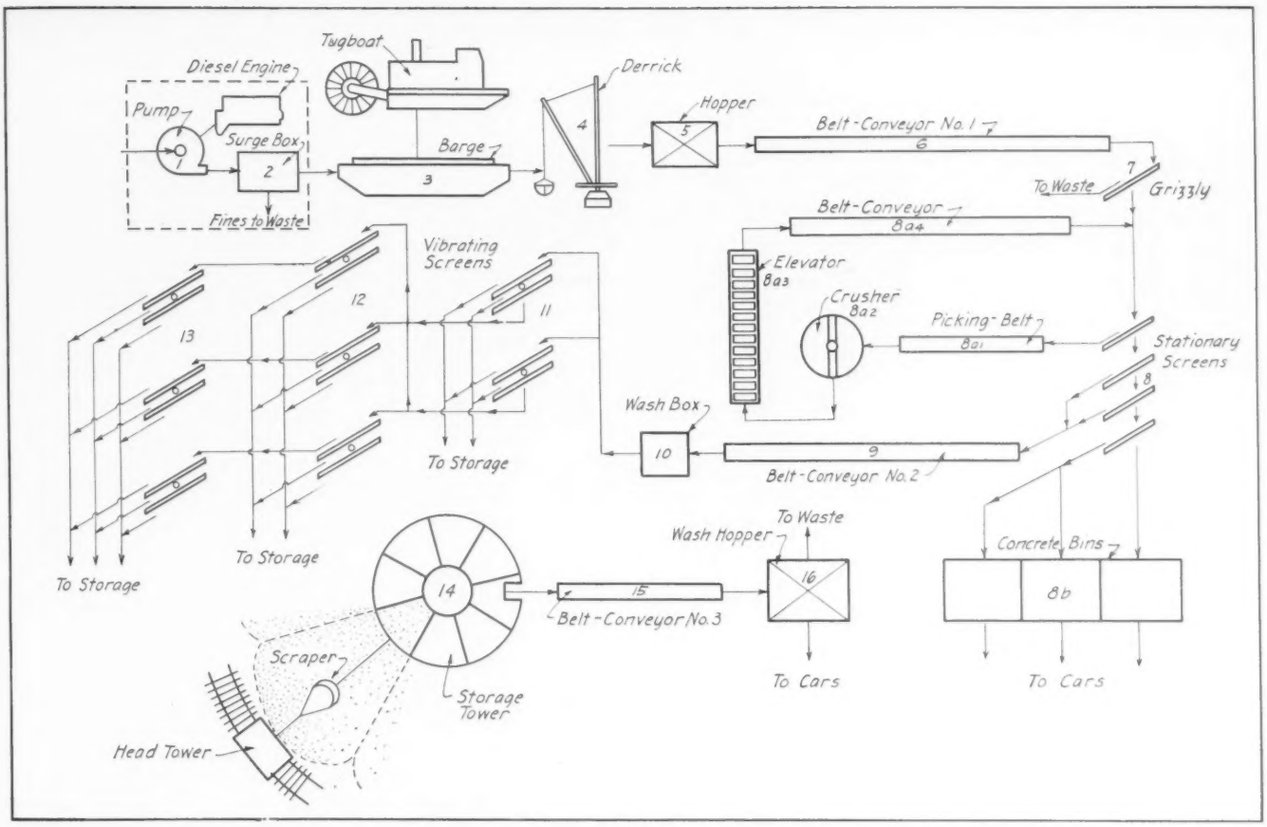
The dredge and plant were designed by the company's engineers in coöperation with the engineering departments of the various companies supplying equipment. The tower storage system was designed by Fred T. Kern, inventor of this system, but was erected by the company's forces which also did all the other construction and installation work. The screening, storage and handling facilities of the plant are new and are built around parts of the original plant which are used for unloading, scalping and crushing. The new parts of the plant are of structural-steel construction and have foundations and footings of concrete.

The plant is located on Meramec River, about 32 mi. west of St. Louis. The deposit is being recovered by dredging back from the river. The overburden of light soil has an average depth of over 10 ft. and the sand-and-gravel deposit, beginning at the normal water-level, varies from 25 to 30 ft. in depth. Below the gravel is a layer of clay and hard pan. The overburden is caved in with the sand-and-gravel bed, which averages about 50 per cent. sand and 50 per cent. gravel. The system for wasting the "fines" on the dredge disposes of the silt and most of the finer sand.

The variation of the river-level sometimes interferes with dredging operations, as the high and low levels during an operating season may vary as much as 30 ft.

When the plant was first put into operation all the material entering the dredge was put through the plant. As almost half of this material, fine gravel, sand and silt, was wasted later, the capacity and efficiency of the plant were greatly curtailed. To overcome this feature a surge-box, which allows the return of undesired material back into the river during the dredging operation, was installed. This arrangement avoids the haulage of waste to the plant and its handling there. It results also in a much cleaner and more accurately graded product and a greatly increased efficiency in

Barge unloading dock and derrick with crushing-and-screening plant in background.

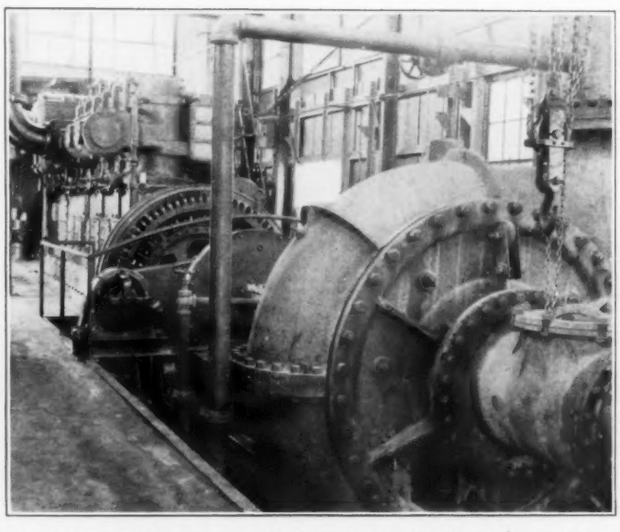


Flow-sheet of the Missouri Portland Cement Co. sand-and-gravel plant.

the production of salable finished material.

The new dredge is one of the largest and most modern hydraulic dredges in the sand-and-gravel industry. Its reinforced-steel hull is 30 ft. wide and 130 ft. long and has longitudinal bulkheads. The hull was rebuilt from an American Bridge Works barge and has a structural-steel-frame superstructure inclosed with American corrugated metal. The hull was formerly used as the hull for a steam dredge with two 15-in. pumps.

The 40-ft. suction-line of the dredge is supported from a structural-steel A-frame and is connected to the dredge pump intake-line by a bellows joint. Bars across the intake nozzle keep out stones too large for the pump and a clean-out fitting is installed in the line just ahead of the pump. A 2-drum hoist operates the intake-line. The dredge pump, a Morris Type H, has a 22-in. suction and a 22-in. discharge. It has a horizontally-split outer shell and a removable manganese-steel shell liner. The disk liners and impeller are also of manganese steel.



The 22-in. dredge pump which is driven by the 840-hp. Diesel engine shown in background.

The pump is driven by an 840-hp. Fairbanks-Morse 2-cycle, 6-cylinder, full-Diesel engine through a Cutler-Hammer 54-in.-diameter magnetic clutch. This engine has a speed range of from 140 to 277 r.p.m. The 22-in. dredge-pump discharge-line is connected to a surge-box placed above the rear end of the dredge. Perforated plates and bars allow the waste of silt, sand and fine gravel back into the river. The material retained in this box is chuted to barges alongside the dredge.

The Diesel engine is equipped with all the latest aids to efficient and economical operation. It has an air-filter on the intake and Brown exhaust temperature indicators. An automatic bell system sounds an alarm when the oil or water runs low. A Sharpless Centrifuge cleans the lubricating oil, which is fed to it by a special oil pump. A 5-in. centrifugal pump primes the dredge pump and a 4-in. pump furnishes cooling water for the Diesel engine. A 2-in. pump supplies cooling water for the pump bearings and a high-pressure pump provides water for the nozzle-jet which agitates the deposit. Fuel oil for the engine is kept in two 5,000-gal. storage-

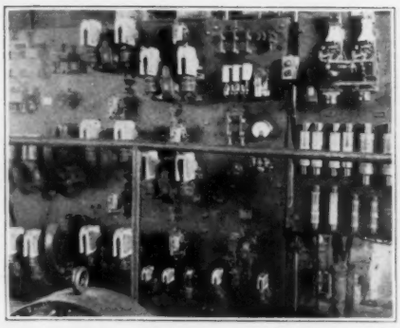
tanks at the rear of the dredge. The air used for starting the engine is furnished by a 250-lb.-pressure air-compressor and is stored in two tanks.

Directly connected to the Diesel engine is a Fairbanks-Morse Type E 440-v., 250-kv.-a. alternating-current generator which supplies the electrical power for all operations on the dredge. A direct-current generator of the same make is chain-driven

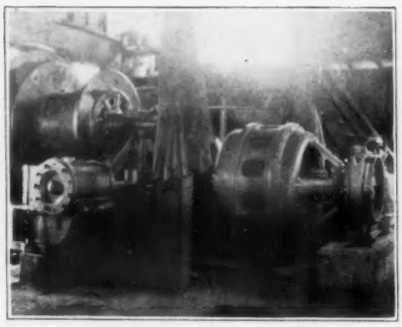
TABULAR ANALYSIS OF THE OPERATIONS AND EQUIPMENT OF THE SAND-AND-GRAVEL PLANT OF THE MISSOURI PORTLAND CEMENT CO. AT JEDBURG, MO.

(Key numbers refer to corresponding numbers on accompanying flow sheet.)

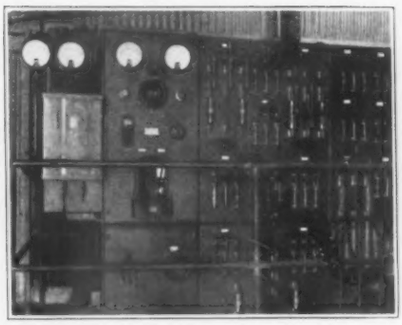
Operation	Key	Equipment	Make	Model No. Size, Capacity or Type	Power Source	Power Transmission
Dredging	1	Dredge pump	Morris	20-in. centrifugal	Fairbanks-Morse 840-hp., 6-cyl. Model 33, Style M Diesel engine	Cutler-Hammer 60-in. magnetic clutch
		Intake hoist	American Hoist & Derrick Co.	2-drum	75-hp. General Electric	
		Shore-line hoist	Thomas	2-drum	75-hp. General Electric	
		Air-compressor	Curtis		5-hp. Fairbanks-Morse	Direct-connected
		Priming pump	Fairbanks-Morse	4-in. centrifugal	15-hp. Fairbanks-Morse	Direct-connected
		Cooling water pumps (2)	Fairbanks-Morse	2-in. centrifugal	15-hp. Fairbanks-Morse	Direct-connected
	2	Surge-box (Fines to waste, coarse to 3)		5 by 26-ft. steel		
Transportation to plant	3	Barges	American Bridge Works	500-ton capacity, 30 by 130-ft. steel, flat deck		
		Towboat		Stern-wheel steamer		
	4	Stiff-leg derrick		10-ton capacity, handles 3-cu.yd. Hayward clam-shell bucket		
		Main hoist	Lidgerwood	2-drum	350-hp. Westinghouse with Westinghouse Type D magnetic brake	
		Swing hoist	Lidgerwood	1-drum	Has Westinghouse magnetic brake	
	5	Hopper		35-ton capacity	Has Westinghouse magnetic brake	
Scalping and removal of fines	6	Belt-conveyor No. 1	Link-Belt	30-in. by 250-ft. centers	75-hp.	Belt and shaft
	7	Grizzly (Oversize wasted, throughs to 8)		Bar		
	8	Stationary screens (Over top-deck to $8a_1$, over and through bottom deck to bins $8b_1$, all other sizes to 9)		Gravity		
Picking, secondary scalping and crushing	$8a_1$	Picking belt-conveyor	Link-Belt	26-in. by 25-ft. centers	5-hp. Westinghouse	Belt
	$8a_2$	Crusher	Allis-Chalmers	McCully 6-in. gyratory	50-hp. Allis-Chalmers	Belt
	$8a_3$	Elevator	Link-Belt	7 by 14-in. bucket	7½-hp. Allis-Chalmers	Belt
	$8a_4$	Belt-conveyor (To 8)	Link-Belt		5-hp. Allis-Chalmers	Belt
Fines storage	$8b_1$	(From 8) Storage-bins (3) (To cars)		Concrete		
Sizing		(From 8)				
	9	Belt-conveyor No. 2	Link-Belt	30-in. by 245-ft. centers	30-hp. Westinghouse	Link-Belt silent chain
	10	Wash-box				
	11	Vibrating screens (2) (Retained on top-deck to 14, retained on bottom decks to 14, throughs to 12)	Telsmith	4 by 10-ft., 2-deck	7½-hp. Allis-Chalmers	Texrope
	12	Vibrating screens (3) (Retained on top-deck to 13, retained on bottom deck to 14, throughs to 14)	Telsmith	3 by 8-ft., 2-deck	5-hp. Allis-Chalmers	Texrope
	13	Vibrating screens (3) (Top-deck oversize to 14, bottom deck oversize to 14, throughs to 14)	Telsmith	3 by 8-ft., 2-deck	5-hp. Allis-Chalmers	Texrope
Storage		(From 11, 12 and 13)				
	14	Storage-tower	Kern	Capacity, live 3,000 tons, total 300,000 tons		
		Bin gates (8) (To 15)				
		Drag-scraper	Sauerman	Crescent 2-cu. yd.		
		Scraper hoist	Kern	2-drum, 2-speed	75-hp. Allis-Chalmers	
		Head tower	Kern	60-ft. high, 30-ft. gage track	20-hp. Allis-Chalmers	Johnson gear reducer
Loading		(From 14)				
	15	Belt-conveyor No. 3	Link-Belt	30-in. by 260-ft. centers	50-hp. Westinghouse	Link-Belt silent chain
	16	Loading hopper (To cars)		35-ton capacity, steel		
Miscellaneous		Air-compressor	Curtis	2-cyl. 8 by 8-in.	30-hp. Westinghouse	Flat belt
		Wash-water pump	Fairbanks-Morse	12-in. centrifugal	200-hp. Fairbanks-Morse	Direct-connected
		Cranes (2)	McMyler / Link-Belt	20-ton, handling 1¼-cu. yd. Hayward clam-shell buckets		



The switchboard which controls most of plant operations.



Barge-unloading hoist with motor and solenoid brake at right.



The switchboard which controls all motors on the dredge.

from the other machine and supplies current for its excitation. A main switchboard controls all the electric motors on the dredge. Among the equipment on this board are an automatic voltage regulator for the alternating-current generator and push-button switches for all the motors. A small motor-generator set operates the magnetic clutch and a small transformer reduces the current to 110 v. for lighting. A Continental 6-cylinder, gasoline engine drives a Fairbanks-Morse 440-v. 25-kv.-a. auxiliary alternating-current generator which supplies power for the oil and water pumps while the Diesel engine is being started. A 5-ton chain hoist on an overhead rail serves the dredge pump and the engine.

Each of the steel flat-deck barges is 30 ft. wide and 130 ft. long and has a capacity of 500 tons. The barges are towed a distance of about 1½ mi. to the plant by the steamer *John H. Soell*. This boat is propelled by a stern paddle-wheel operated by a steam engine having two 10-in. by 4-ft. stroke cylinders. Two boilers furnish steam at 165-lb. pressure.

The barges are moored alongside the unloading dock at the plant. A 10-ton, stiff-leg derrick handling a 3-cu.yd. clam-shell bucket unloads material from the barges into a 35-ton steel-frame timber hopper. The bucket is operated by a 2-drum hoist and the swing by a 1-drum hoist. Both hoists have magnetic brakes. Another hoist operates the lines which hold the barges at the dock for loading. The material is discharged from the hopper through a sliding gate on a 30-in. belt-conveyor (No. 1) which feeds an inclined dump table. This table has a set of loose grizzly bars which can be set at any desired spacing. Oversize material is rejected into a bin from which it is loaded into cars and hauled away to a waste dump. The material passing through the bars is fed to a series of four stationary screens located one above the other and equipped with water jets which wash the material and help to drive it through the screen openings. These screens are equipped with 2¼-in., 1-in., 3-mesh, and 4-mesh screen cloth. The oversize (plus 2-in.) material from the top screen is discharged to a 26-in. horizontal belt-conveyor which is used for hand picking of sticks, mud, shells, etc. This conveyor discharges into an Allis-Chalmers 6-in. McCully gyratory crusher which reduces the oversize gravel to 2-in. minus. The crusher discharge goes to a vertical bucket-elevator and, by a short belt-conveyor, back to the stationary screens. The sand separated from the gravel through the stationary gravity screens passes to sand-gradation and wash-boxes from which the desirable products are chuted to concrete storage-bins, while the wash-water silt and undesirable sand are carried away from the plant by flume. From the bins sand is loaded into cars for shipment, or is drawn for stock-piling.

The screening-and-storage tower with drag-scraper reclaiming stock-piled material.

All the material retained on or above the third stationary screen (1-in. to 2¼-in.), is chuted to a 30-in. belt-conveyor (No. 2), which carries them to the screening plant on the top of the storage-tower. There they are discharged into a wash-box where water is added. From this box the material is discharged into a split chute feeding two Telsmith 4-ft. by 10-ft. double-deck vibrating screens. These have 1⅝-in. and 1⅛-in. openings on their top and bottom decks respectively.

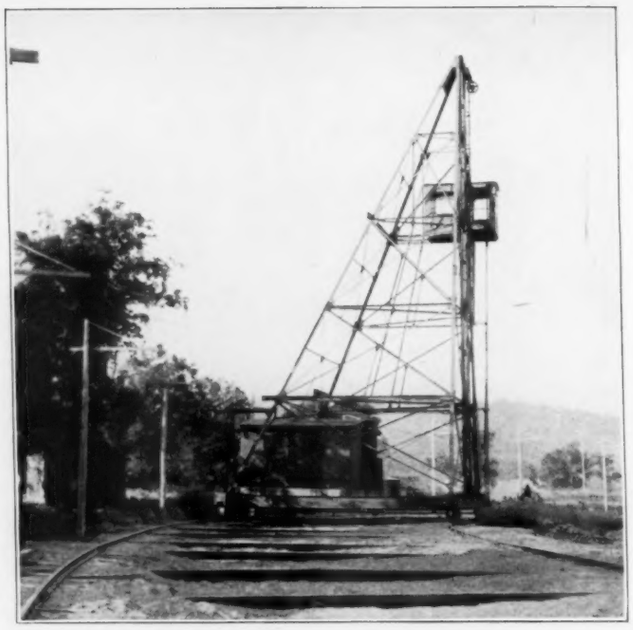
The two sizes of material retained on both decks of these screens are chuted to separate storage compartments. The material passing through the bottom decks is fed by an arrangement of split chutes to three 3-ft. by 8-ft. Telsmith double-deck vibrating screens, which have ½-in. openings on their top

decks and Tyler Toncap cloth having 3/16-in. by ½-in. openings on their bottom decks. The two undersizes of material from these screens go to storage, the minus 4-mesh first passing over stationary dewatering screens. The oversize material from the top decks goes to three more 3-ft. by 8-ft. screens with ⅞-in. and ½-in. openings on their top and bottom decks respectively. The two sizes of material retained on the two decks of these three screens also are chuted to storage. The material passing through their lower decks is discharged to the same chutes as the material retained on the lower decks of the first group of three screens.

The storage-tower at this plant has eight radial compartments, of which seven are being used for storage. These compartments have a total live-storage capacity of about 3,000 tons. Materials are rehandled by a 2-cu.yd. Sauerman Crescent scraper which makes possible a total storage capacity of about 300,000 tons. As in other Kern installations, the tail pulley of the scraper system is fastened to a steel ring surrounding the tower just above the tops of the storage partitions.

The movable head tower of this system is a 60-ft. steel structure running on a 30-ft.-gage circular track, the inner rail of which is 250 ft. from the center of the tower. This tower is supported on four 2-wheeled trucks and is driven through two wheels by an electric motor. The scraper is operated by a Kern 2-drum, 2-speed electrically-operated hoist, which has the same speed in each direction and is driven through an automobile-type transmission. To reverse the direction of haul of the scraper it is only necessary to reverse the cables on the scraper bucket. The scraper operator sits in a room built in the top of the head tower and controls the scraper and tower operations through hand levers. The tower has a heavy reinforced-concrete floor which serves as a counterbalance to the pull of the scraper. Electric current is obtained from a 3-wire trolley line paralleling the tracks.

The live-stored material at the base of the storage-tower is fed by gravity through segmental gates (one for each compartment), which discharge into a 3-ft. by 6-ft. receiving hopper. These gates are marked with holes so that they can be set to give any desired mixture of the various sizes in storage. This hopper controls the discharge to a 30-in. inclined belt-conveyor (No. 3), the lower end of which is in a welded steel-plate tunnel with



The 60-ft. head tower of scraper system with trolley wires and 30-ft.-gage circular track.

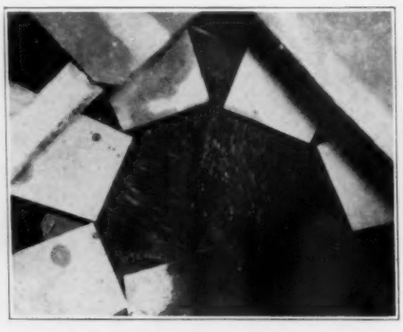
concrete foundations under the tower. This belt-conveyor feeds a 35-ton steel hopper, the material being rinsed by a spray as it leaves the belt. Two 3-ft. by 6-ft. perforated plates in the bottom of this hopper allow the water and waste to run into a drainage ditch. Cars are loaded from the hopper through gates and chutes in two sides.

Two 20-ton cranes, with 1¼-cu. yd. clam-shell buckets, are also used for reclaiming stock-piled materials. The material produced at this plant is used for state and county highway work and a considerable quantity is shipped to St. Louis. Some of the torpedo gravel produced is sold to a roofing company which has a plant near. A 2,000-ft. siding connects the gravel plant to the Missouri Pacific Railway. Two steam locomotives are employed for switching cars.

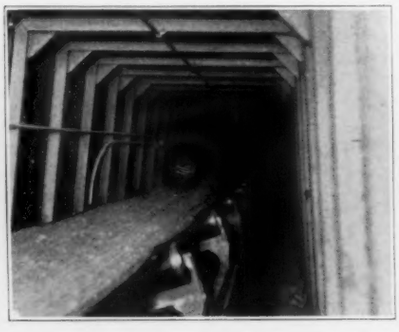
The plant-control system also contributes to its safety and ease of operation. The equipment in the unloading hoist-house is controlled from a Westinghouse master switchboard. The operator stands on a platform from which he can observe all operations and controls the hoist by means of levers.

(*Continued on page 40*)

One of the eight double-deck sizing screens in the storage-tower.



Looking down on tower gates with material being mixed on conveyor.



Tunnel conveyor which feeds from storage-tower to loading building.

Practical Value of Economic Geology in the Manufacture of Cement

Accurate Knowledge of Raw-Material Resources Is Essential to Success

By DR. BENJAMIN L. MILLER
Department of Geology, Lehigh University

APPLIED or economic geology has "come into its own" in recent years because of its successes in various fields, but especially in the oil and gas industry. During the industrial "boom" just preceding 1929 hundreds of geologists in the employ of oil and gas companies were distributed throughout the world in every region offering even the slightest prospect of containing any of these valuable gaseous and liquid fuels. For several years most geologists were engaged in geological investigations to locate new supplies of oil or gas. The results of their work are largely responsible for the deplorable overproduction which has brought distress and even disaster to the oil industry.

The value of geological advice in the oil and gas companies has been so thoroughly established and has been so frequently described that it seems to overshadow the importance of geology in other fields. Nevertheless geological studies in all branches of mining and quarrying, as well as in various engineering projects such as the building of dams, the driving of tunnels and the construction of building foundations, have proved to be highly practical and profitable.

In the cement industry, which the author has been requested to discuss particularly in this article, comparatively little geological work has been done up to the present, although here, too, there is a growing realization of the importance of geology. The failure to appreciate some of the very simple principles of the science has seriously interfered with the success of a number of projects and, on the other hand, geological advice has resulted in highly effective economies. One cement operator has told the writer that, in his estimation, geological investigations for his company would, over a term of years, effect a saving of upwards of a million dollars. This case is doubtless exceptional, but there are other instances in which cement plants costing a few million dollars each have been erected in places where there is little likelihood of their ever becoming commercially successful, because of the character of the deposits of the raw materials, and where geological examinations might have shown the unfavorable features.

The work of a geologist in the cement industry consists of an investigation of the composition of the materials employed in the manufacturing of cement and the way in which they occur. These investigations lead to calculations of the quantities of stone available and to the methods of working the deposits most economically. These practical matters are so largely dependent upon the origin of the strata and upon subsequent changes which they have undergone, that it seems advisable to consider briefly the origin of the principal raw products that enter into the composition of cement and then to discuss the character of the subsequent changes which may have taken place and the criteria for their recognition.

There are a number of natural raw materials as well as by-products of other manufacturing plants used in manufacturing cement. The calcareous ingredients are derived from limestone, marl, chalk, fossil and recent shells, the slags of blast-furnaces and the refuse of other manufacturing activities; the aluminum, iron and silica are mainly derived from shales or clays, but in part from slags, sand, iron ore, bauxite, etc. Let us consider the origin

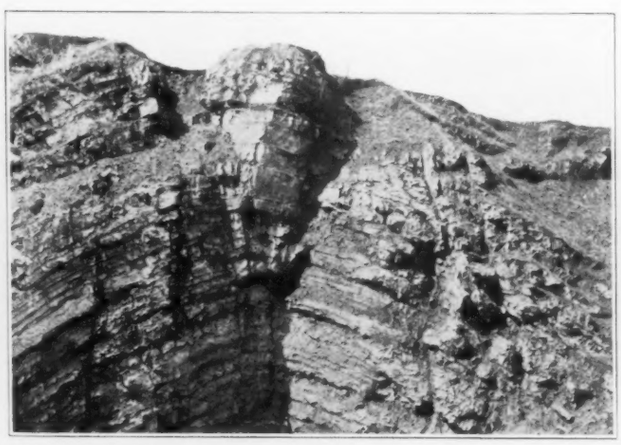


Fig. 1. Simply-folded limestone.

Fig. 2. Intricately-folded limestone.

of the most important of the natural products, limestones, chalk, marl, shell deposits, clay and shale.

Limestones.—There are many different kinds of limestones, each of which was formed in its own peculiar manner. They are all alike as to origin in that they consist primarily of calcium carbonate which was originally in solution in either fresh or marine waters. The original calcium was a part of some of the complex silicate minerals of igneous rocks that now compose the greater part of the earth and, in the beginning, the entire earth. The silicates decomposed in the process of weathering and allowed the small amount of calcium to unite with carbon dioxide from the air to form calcium carbonate, which was dissolved by surface or ground waters. In solution the calcium carbonate was transported by the surface and subterranean streams and eventually in large part reached the ocean.

The precipitation or extraction of calcium carbonate from solution in the ocean waters, where it is universally present in small amounts, may be accomplished in different ways. Some is precipitated as the result of purely physical and chemical processes, but deposits formed in this manner are too restricted to warrant their description here. Practically all our limestones owe their origin to the removal of the calcium carbonate from solution through the agency of organic life, either animal or plant. In the case of animals possessing shells or bones, and also in some plants, the lime compounds are removed and built into the external or internal structures in the process of digestion or assimilation. In other instances the precipitation is accomplished by chemical changes produced by the life processes of the animals and plants, even though the precipitated matter does not enter into their structures. A large variety of animals and plants are concerned in the production of limestones. Some owe their origin mainly to the mollusca, others to corals, to bacteria, to algae, etc.

Regardless of the method of extraction, the calcium compounds taken from the waters eventually accumulate in the bottom of the body of water, either during the life of the organisms or after their death. The rate of accumulation is variable, but on the whole extremely slow, so that an inch of limestone, on the average, represents a number of decades.

The variety of limestones depends largely upon the impurities which they contain. Nearly all present evidence of their deposition in shallow ocean water. That is the place where calcareous secreting organisms are most abundant. Most shallow marine waters are close to the shores of land masses and, therefore, it is not strange to find that sand and clays of different kinds from the land have been carried into the oceans and mingled with the calcium-carbonate deposits. We find all gradations from pure limestones through shaly limestones into shales or through sandy limestones into sandstones. These variations and gradations may be sudden or extremely slow and gradual. In one geographic location pure calcium-carbonate limestones may form to a great thickness, whereas in another locality there may be many alternations between pure limestones and those containing abundant and varied impurities. In the former case conditions remained uniform during long periods of time and there were no land-derived sediments transported to the locality. In the latter, at intervals, clay or sand particles carried in suspension by streams or waves were brought to the place and dropped into the lime oozes forming there.

These conditions explain the variability of limestones and should be clearly borne in mind by all users of limestone. Too often the writer has found that the persons directing the operation of a limestone quarry fail to appreciate that certain beds or series of beds that roughly constitute a unit because of similarities—called formations by geologists—may be remarkably uniform over large areas and through great thicknesses, whereas other formations may be characterized by frequent and abrupt changes, so that the character of rock found at one place furnishes little indication of what may be expected at another place. A single bed of limestone in some instances may extend over an area from 20 to 40 mi. long with only the slightest variations in thickness, physical characteristics and chemical composition, but in other localities there were such frequent changes during the formation of the rocks that one dare not form definite conclusions without detailed observations. The general character of the formation with which one is dealing must be determined in order to formulate proper plans for prospecting. It is as positively a mistake, although not as serious, to drill 50 prospect holes in a property where marked uniformity prevails, if 10 holes would be sufficient, as to drill only 10 in a region of variable rocks where 50 are necessary to form an adequate picture of the situation. The writer has observed mistakes of both kinds.

One of the impurities with which cement manufacturers in many parts of the country have to contend is magnesia. Most of our limestones contain at least a small percentage of magnesium carbonate. This is almost inevitable, since magnesium compounds exist in our igneous rocks and in weathering act in almost the same ways as the calcium minerals. The magnesium carbonate enters the ocean waters, where it exists in larger quantities than calcium carbonate. The reason for its greater abundance there is simply that it is not as readily removed by organisms. However, almost all plants and animals that extract calcium carbonate also precipitate some magnesium carbonate. Analyses of shells and skeletons of both animals and plants show the presence of magnesium carbonate in amounts up to 25 per cent. It is, therefore, assumed that most of the calcareous oozes were originally slightly magnesium, although it is doubtful whether the original composition was the same as that we find now in our limestones. Some subsequent changes are generally believed to have taken place. Naturally, many different explanations have been offered, but these can not be described here. A common belief, and one which is held by the writer, is that there was in some cases

a later selective removal of part of the calcium carbonate by solution in the warm shallow ocean waters before they were deeply covered by subsequent deposits and also a substitution of some magnesium for the calcium removed. It is common to find high- and low-magnesium limestones interbedded in such thin strata that it is practically impossible to separate the two in quarrying except by careful hand loading. The only explanation we have to offer for the formation in the same place of these alternate beds of different composition is that they represent physical and chemical changes in the ocean waters as well as, possibly, changes in the lime secreting organisms.

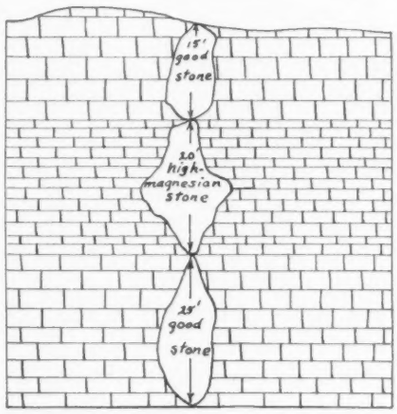


Fig. 3.

Chalk.—In the Unted States deposits of chalk are much less important than in northwestern Europe, where they have been used as a source of lime, cement and fertilizers for centuries. Nevertheless, they are present in some of the Mesozoic formations of the western and southern states.

Chalk is only a variety of limestone and differs essentially from the more common limestones only in its lesser degree of cementation. It can be crumbled in the hand and is useless for any structural purposes. All the harder limestones have once passed through a similar stage of feeble cementation and in some instances subsequent selective solution of once-hard limestones has removed so much of the cementing matter that they are again in the chalk stage. A notable case of this sort is located near Annville, Pa. Here a small area of Ordovician limestones is now so soft, because of the removal of much of the calcareous cement, that they are worked for agricultural limestone by means of a shovel without any drilling or blasting.

Some of the chalk deposits are composed mainly of foraminifera, a group of tiny low-order marine animals. However, for that matter, some of our normal limestones are likewise composed largely of this type of organism. In some chalk deposits, particularly those of Europe, nodules of flint, formed by subsequent segregation of silica by circulating ground waters, are abundant. This feature also is not peculiar to chalk, but is common to many of our ordinary limestones.

Marl.—The term "marl," unfortunately, has been used for a number of different kinds of deposits. For example, in New Jersey, it is applied to glauconitic sand deposits that have been dug for fertilizing purposes; in Virginia it designates a deposit of fragmental fossil shells; elsewhere, but particularly in New York and Michigan, it denotes a deposit of fine structureless calcareous ooze in which there are likely to be numerous small-coiled shells of mollusks. The last use of this term seems to be the proper one and is the one accepted by the writer.

Calcareous marl is common in limestone regions where there are shallow lakes or swamps. Since most of our lakes are in glaciated regions, formed by the damming of streams by glacial deposits, nearly all the calcareous-marl deposits of the United States are confined to the northern part of the country. The most important ones are located in Michigan, where they have furnished material for the manufacture of Portland cement. One situated in the glaciated section of northern New Jersey has been prospected for this purpose, but the quantity has been found to be insufficient.

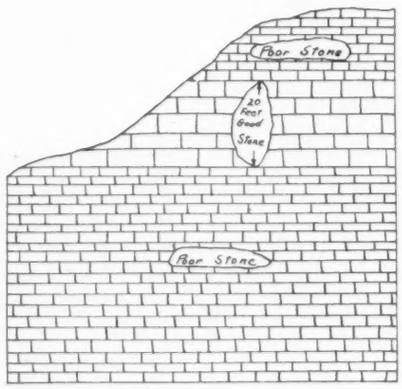


Fig. 4.

Freshwater calcareous marl owes its origin mainly to the precipitation of calcium carbonate by a particular plant known as *chara*. They are sometimes called *chara* marls. The small shell-bearing animals contribute their shells and in places these make up a considerable part of the deposit.

Shell Deposits.—There are different kinds of shell deposits of economic importance. Some are composed of accumulations of recent shells, such as the extensive oyster-shell deposits that are found in an arm of San Francisco Bay. These deposits are up to 30 ft. in thickness and are now being dredged for the manufacture of Portland cement. A small form of oyster lived there for many years in great numbers to produce such an extensive accumulation of shells, but at present there are no living specimens in the vicinity.

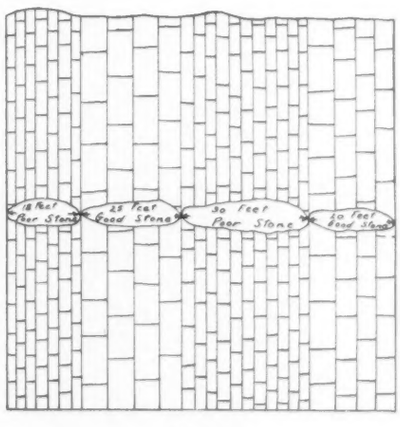


Fig. 5.

In various places in the Atlantic and Gulf Coastal Plain there are great deposits of fossil shells that are mainly fragmental, due to wave action while they were in the process of accumulation. One of

these deposits, located a short distance west of Norfolk, Va., furnishes the calcareous material for a cement plant. Some sand and clay occurring with them are readily removed by washing.

Shell deposits require little explanation as their origin is evident to any one. Many different groups of animals and plants are represented, including the various divisions of the Mollusca, corals, calcareous algae, etc. They are similar in almost every particular to the beach-shell deposits now forming about the margins of some of our tropical or semi-tropical oceans.

Clays and Shales.—The clays and shales, so largely used in the cement industry as the source of silica, alumina and iron, are the products of decomposition of many different kinds of minerals of the igneous rocks. They are composed of insoluble materials which are transported in suspension by running water to the places where they are now found. They vary in composition because of the variation in composition of the original minerals from which they have been derived.

Clays and shales have the same origin and differ little, if any, except in their physical characteristics. The shales have been compacted by pressure, whereas the clays are unconsolidated. Some of the shales change mineralogically, but not chemically, when they have been subjected to intense pressure and consequent high temperatures. The extreme change of this sort results in the formation of slates and schists.

Clays and shales may form in either fresh or marine waters. Actually, however, the greater portion are marine deposits. They are thin-bedded, which means that there are frequent cessations of deposition. A single bed or layer may represent a freshet when the streams brought in a large amount of mud. This was followed by a period of slack water in which the streams were relatively clear and little or no mud was carried.

We have a distinct type of clay deposit that in a few sections is of commercial importance in the cement industry. This is glacial clay, which is widespread throughout the northern portion of the country. As the ice advanced over the region it picked up the surface soil and other loose materials. These were either all dropped where the ice melted or the finer portions were carried some distance farther by the water resulting from the melting of the ice. In the former case the clay is plentifully mixed with bowlders and sand; in the latter, the clay is relatively free from these materials, although at times some bowlders carried from the front of the glacier by floating ice masses have been dropped into these well-assorted clay deposits.

In this brief survey of the origin of the common materials used in the production of cement no attempt has been made to discuss all the variations of each type of rock. It has been thought necessary to call attention only to the general features which should be clearly understood by any one engaged in the quarrying of any of these products. It may be thought by some that such descriptions as given are unnecessary, but the experiences of the writer seem to indicate that they have a very definite value.

Structures of the Cement Materials.—With the exception of the glacial deposits, all the products described above have been formed by the deposition of materials in bodies of water either from solution or from suspension. They constitute layers, beds or strata that have much greater areal extent than vertical thickness. There are many variations. One bed only a foot or so in thickness may extend over 100 sq. mi. and, on the other hand, in certain cases a deposit 20 ft. or more in thickness may have an areal distribution of only a few square miles.

In general all sedimentary rocks are laid down in approximately horizontal positions. If the surface on which the deposits have been laid is irregular, there is a marked tendency for the sediments first to fill all existing depressions and after that to form horizontal beds over the regular surface.

In some sections of the country horizontality still prevails, although the rocks originally beneath the ocean waters are now hundreds of feet above sea-level. They have been uplifted without deformation. In fact, in many cases they have been alternately uplifted and depressed perhaps several times, and yet still preserve their approximate horizontal position. In such cases there are few problems that confront the quarryman after he has become familiar with the thicknesses, areal extent, chemical composition, and physical character of the different strata.

Throughout a large part of the country, especially in the Appalachian province, the strata no longer maintain their original horizontal position. In the various changes of level which have taken place the beds have been tilted, folded or broken. The degree of change varies from beds that have been tilted only a few degrees to some that now stand vertical or have been overturned. The complexity of rock structures is almost unbelievable to those persons who have always worked in regions of horizontal rocks. We ordinarily think of rocks as unyielding except by crushing. We now know, however, that under conditions of heavy loading and slowly-acting forces of compression even our hardest rocks may be folded as intricately as a sheet of paper and without breaking (Figs. 1 and 2).

In the folding of rocks there are great differences which depend upon the character of the sediments. Naturally, thin-bedded rocks, such as shales, will crumple more easily than massively-bedded limestones. In a region where both kinds of rocks are found the shale may be thrown into small folds, each fold involving only a few inches of material, whereas thick limestone or sandstone beds will be thrown into great folds with single folds perhaps several miles across. If the forces responsible for the folding are sufficiently intense even the thickest strata may become complexly distorted. In general, the thin beds behave as tissue paper and the thick ones as cardboard when subjected to lateral compression.

The causes and nature of rock folding have long been under investigation, but it must be admitted

that there are a variety of explanations extant and geologists generally feel that this is still one of the live research problems.

In the latter part of this paper some typical structural problems are cited to show the importance of the determination of the structures of the strata in any district.

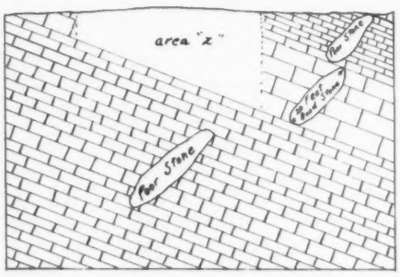


Fig. 6.

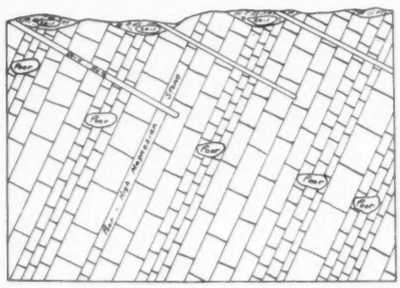


Fig. 7.

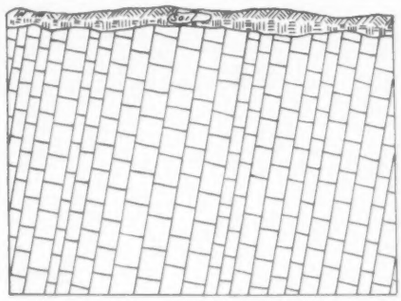


Fig. 8.

When rocks under great compression become distorted they may become sufficiently plastic to fold without breaking. In some instances the movement is so great that the beds are stretched and eventually break, and the broken portions become widely separated. In other cases the beds are not sufficiently loaded to become plastic and consequently break. The process of the breaking and separation of once-continuous beds is called *faulting* and the plane of displacement is called a *fault.*

In practically every part of the world, where at any time there has been mountain building, some of the strata are displaced by faulting. It is the function of the geologist to determine the presence or absence of faults and also the character of the faulting and the amount of displacement where faulting has taken place.

Problems of the Cement Geologist.—To illustrate the work of the geologist in the cement industry a number of specific examples or problems are cited. Obviously, where these are illustrated by concrete cases, the names of the companies are omitted.

One of the serious problems confronting some of the cement companies is the presence of objectionable amounts of magnesia. This is of great concern because of the permissible limit of 5 per cent. of MgO in the finished cement. It so happens that along the northern Atlantic border, where the bulk of the Portland cement of the country is consumed, there is much magnesia in the limestones, so that care must be taken in locating sites for cement plants. Because of the cost of transporting a bulky product such as cement, it would be highly desirable to have plants located as close to the larger cities as possible and the writer has, therefore, been asked to make various investigations of limestones in the neighborhood of the leading cities of the eastern coast. The limestones occurring nearest Boston, Providence, New York and Baltimore are not used for cement because of their high magnesian content, and it was only after prolonged field studies and much drilling that a favorable location for a cement plant in which the magnesia was sufficiently low was found in the limestones lying closest to Philadelphia.

The limestones of the Appalachians belong to the pre-Cambrian or Paleozoic series of rocks. During both these eras conditions were favorable for dolomitization a large part of the time. Some great thicknesses of limestones, aggregating hundreds of feet, contain no beds low in magnesia. Other localities contain interbedded high- and low-magnesian limestones and in such places it must be determined whether it is possible to quarry or mine the desirable stone commercially without detrimental contamination from the high-magnesian beds. The problem is, therefore, first to determine the thickness and the chemical composition of all the beds.

When all the stone in the quarry was hand-loaded, it was possible to sort the low- and high-magnesian rocks shot down by the large blasts, as it is relatively easy to train the quarrymen to distinguish between the two. At present hand loading is not practicable. One of the Portland-cement companies of the Lehigh district once worked a quarry in this sort of stone. The men picked out the dolomite and loaded it in cars that were taken to a near blast-furnace for flux and the high limestone was sent to the cement plant.

If the usable material is in a band or bands 15 to 20 ft. thick with the beds either horizontal or vertical, the deposit may be workable, whereas inclined beds may so increase the cost of quarrying the good stone as to make the proposition unprofitable.

In Fig. 3 we have conditions that may allow the quarrying of the overlying band first, if the areal extend is considerable, then quarrying and either wasting or, preferably, disposing of the magnesian

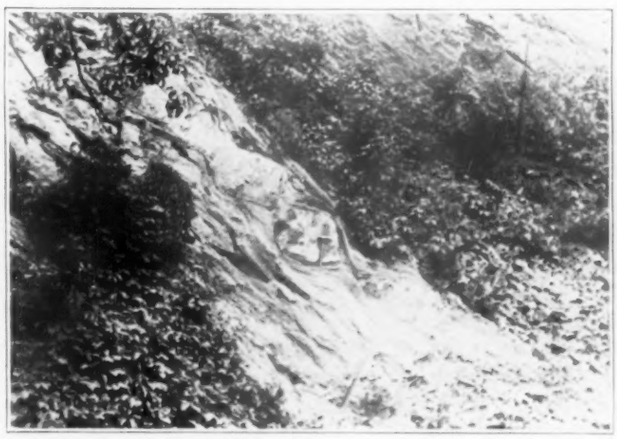


Fig. 9.

stone as crushed stone, and finally working the lower band of satisfactory stone.

In Fig. 4, where a series of horizontal strata outcrop on the side of a hill, with the overlying thickness of poor stone entirely too thick to be removed commercially except near the outcrop, only a limited amount of stone is obtainable except by mining. This is the situation that prevails throughout several counties in western Pennsylvania, where two cement companies and several limestone companies are mining limestone for Portland cement and flux.

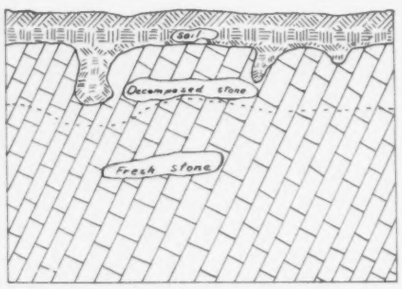


Fig. 10.

In Fig. 5 the vertical beds may allow separate quarrying of the good stone but generally in limited quantities only, because of the danger of the breaking off of large masses from the walls. In places, however, the writer has seen walls so stable that narrow cuts in vertical strata are perfectly safe, even where the excavations have been carried down to a depth of over 200 ft.

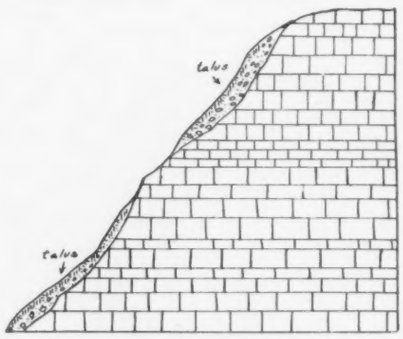


Fig. 11.

In Fig. 6 it is evident that only the area marked x can readily be quarried economically. It is evident that only a limited supply of stone is obtainable without the removal of large quantities of worthless material. Naturally, no hard-and-fast rules or statements can be made as to just how thick the bed must be to be worked economically or how great a thickness of overburden can be removed with profit. It is entirely a matter of costs, and many factors enter into such a consideration.

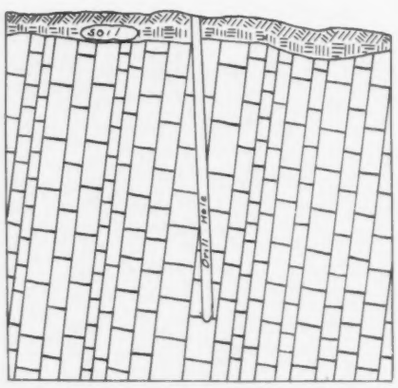


Fig. 12.

The situation shown in Fig. 6 brings up another question which can best be discussed by a concrete example. A property, where an almost continuous series of outcrops showed alternating beds of good limestone and dolomite, was prospected for the location of a cement plant. The width of outcrop or exposure was confused with the thickness of the thickest bed of good stone and an extremely-erroneous calculation of tonnage of desirable stone was made. In other words, it was assumed that the width of the outcrop represented a vertical bed of good stone of that width and that the quarry would be limited in depth only by the quantity of water encountered and the cost of elevating the material. Only the examination of the property by a geologist who recognized the true situation prevented the erection of a cement plant that would positively have resulted in failure.

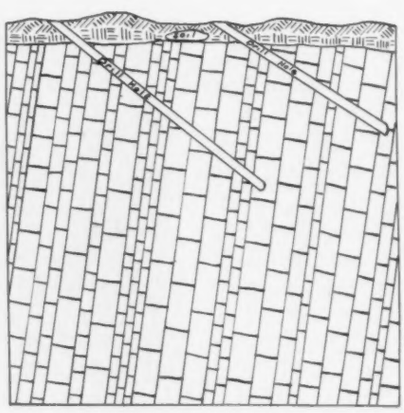


Fig. 13.

In the examination of a region of interbedded high- and low-magnesian limestones a distinction must be made between the ordinary averages of chemical composition and the weighted averages. If all the beds were of equal thickness they would be the same. In the following case the distinction is well brought out. Of course, it must be known how the sampling is done. Some prefer to have all the composite samples represent equal measured distances. The writer believes that a better picture of the exact situation can be obtained by sampling separately each bed regardless of the varying thicknesses.

Thickness ft.	CaO *(Per cent.)*	MgO *(Per cent.)*
10	33.42	16.66
2	42.66	2.46
8	29.10	15.93
3	48.22	1.27
	Average. 38.35	9.08
10 ft. × 33.42 CaO =		330.42
2 ft. × 42.66 CaO =		85.32
8 ft. × 29.10 CaO =		232.80
3 ft. × 48.22 CaO =		144.66
23		793.20
Weighted average (793.20 ÷ 23)		34.49 CaO
10 ft. × 16.66 MgO =		166.60
2 ft. × 2.46 MgO =		4.92
8 ft. × 15.93 MgO =		127.44
3 ft. × 1.27 MgO =		3.81
23		302.77
Weighted average (302.77 ÷ 23)		13.16 MgO

In walking across a region where there are interbedded high- and low-magnesian limestones, with only part of the beds exposed, it might be expected that there would be a tendency for the ones containing the highest percentages of magnesian carbonate to outcrop because of their greater resistance to ordinary solution, while those high in calcium and low in magnesia would be concealed by residual soil. It has been observed by the writer that the opposite situation frequently prevails in regions of fairly-high

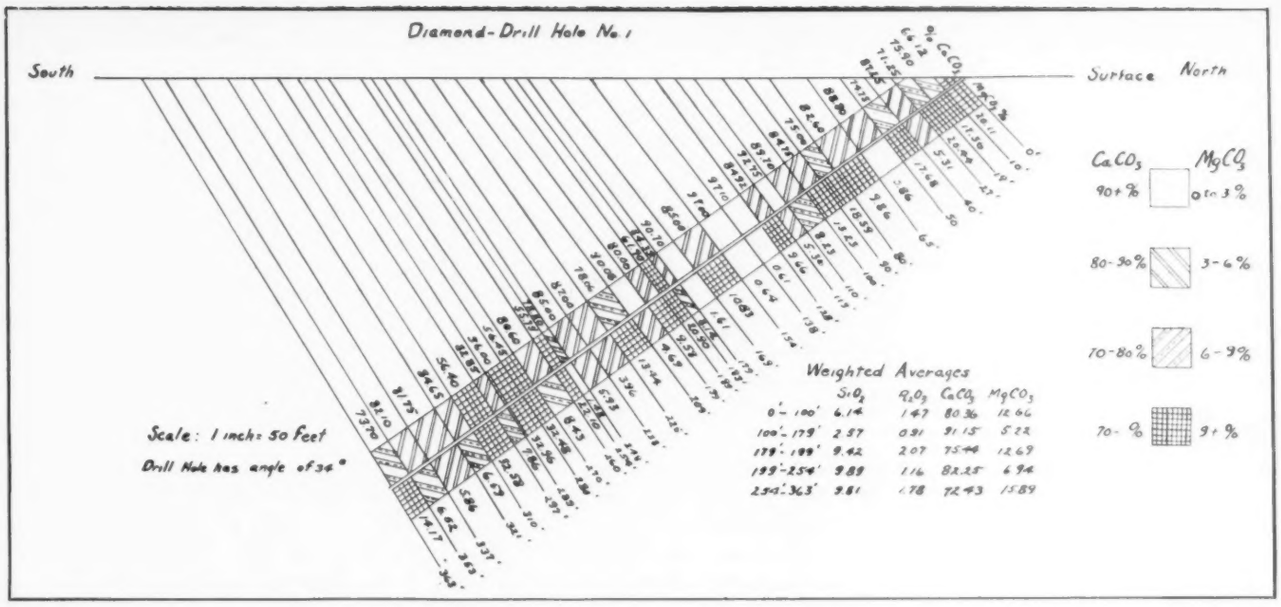


Fig. 14. Data obtained in diamond-drilling prospecting of limestone property.

rainfall and abundant vegetation, resulting in the formation of considerable humus. Therefore, there is need of caution in forming conclusions from outcrops, even though they are numerous and represent far more than half the beds.

Walking across the region which had several soil patches, only one dolomitic bed was observed (Fig. 7). The analyses of samples collected showed the limestones were of such a high quality that the farm was purchased before any trenching or drilling was done. Later, when the property was diamond-drilled by successive holes at right angles to the dip, it was found that practically every gap in the outcrops was represented by strata entirely too high in $MgCO_3$ to be used in Portland-cement manufacture. Whether this is due to an actual difference in the ease of solution of the different chemical compounds or is due entirely to the presence of the greater number of cracks or joints in the dolomitic layers, thus facilitating the entrance and circulation of underground water and aiding in solution, is a question in the writer's mind. There is no doubt that ground water percolates more readily through the Paleozoic dolomitic strata due to more numerous visible or incipient cracks than exist in the associated or interbedded low-magnesian beds. Nevertheless, it seems that the soil waters containing varying amounts of humus acids actually dissolve the high-magnesium limestones more readily than those low in magnesium.

Where strata of interbedded high- and low-magnesian limestones occur in a highly-folded region, there is frequently a tendency for the magnesian strata to be squeezed into lenticular bodies due to flowage of the beds. Fig. 9 shows a bed of dolomite that has been practically squeezed out in certain places and greatly thickened in others, whereas the associated low-magnesian beds show little variation in thickness due to the flowage. In places observed by the writer a dolomite bed may in a short distance vary in thickness from a few inches to several feet. Consequently precaution must be exercised in determining whether the observed thickness of a dolomitic bed is the normal thickness or a reduced or increased one resulting from flowage during the folding of the strata.

These illustrations present some of the vagaries of the interbedded high- and low-magnesian limestones of the Appalachian region. In almost every place it is necessary to exercise caution in locating a site for a limestone quarry to be worked for the manufacture of Portland cement. If outcrops seem to indicate an area of satisfactory stone, it is necessary next to search diligently to see whether there are objectionable dolomitic beds interbedded. More work is usually required to discover the presence of positively detrimental stone or the absence of poor stone than to prove the presence of the good stone, but the dire results of a failure to find objectionable material, when present, amply justify the expenditure of the necessary time and money positively to prove the property. Close to the Lehigh district of Pennsylvania there are the foundations of a cement plant that was well under way before the discovery of so much interbedded dolomite in the deposit of limestone as to make the project a definite failure.

Trenching.—Having recognized the presence of useful and useless interbedded limestones in a property designed to furnish the stone for Portland-cement manufacture, it next becomes necessary to determine its real value if the outcrops do not furnish sufficient information. This can be done either by trenching or by drilling. Naturally, the method chosen should be the cheapest, provided it will furnish the needed information.

Where the overburden is thin and the strata dip gently (Fig. 8), trenching to expose the different beds is satisfactory. If certain of the beds are overlain by upwards of 10 ft. of overburden (Fig. 10), it may not be economical to use this method.

In addition, the edges of the beds exposed in the

trenches may be so weathered that samples obtained for analysis may give misleading results. Beneath a soil cover it is not unusual to find limestones altered by differential or selective solution to a depth of 6 to 8 ft. and locally even more. The alteration is mainly in the partial solution of the $CaCO_3$, but other chemical changes may be produced.

Where the strata are horizontal or approximately so, trenching can not be employed except along hillsides, where the beds outcrop and only there when the hillside *débris* or talus is not too deep (Fig. 11).

Drilling.—In prospecting limestones by drilling various conditions must determine whether the ordinary well-drill or core-drilling is to be employed. In some places, particularly where the strata are horizontal, either one can be used. In such cases there is sometimes a difference of opinion as to which is preferable. Under almost all conditions the well-drill method is much cheaper and should be chosen if the results are satisfactory. If the core-drill could be relied upon to furnish 100 per cent. of core, there would be no question of its superiority, but when the beds are shattered, cavernous, partially-decomposed, or of varying hardness, the core recovery may be even less than 50 per cent. The percentage of recovery at times depends upon the skill of the drill operator. By running the drill more slowly and removing the core at short intervals better results can usually be obtained. In cases where the core recovery is disappointing the writer has insisted upon the collection of the cuttings from the sludge overflow by means of a screen attached to the top of the casing and this material has been analyzed as well as the cores.

In certain hard and fairly-uniform rocks lying in a horizontal position prospecting limestone by well-drills may give entirely reliable results. At other times, particularly when there is clay mixed with the cuttings and washing is necessary, the results may be largely in error. If certain strata are unusually soft, they may be so finely pulverized as to have most of the material washed out with the clay. At times washed samples actually show less $CaCO_3$ analysis than the unwashed, even though there is considerable clay present. In well-drill prospecting there is also danger of pieces of the rock from higher levels falling to the bottom of the hole and becoming mixed with the lower-strata samples. Further, the sample collected for analysis representing only a small part of the cuttings may not be truly representative of the interval drilled.

In regions of horizontal strata the best plan in many cases is to prospect most of the property by the cheaper well-drill method, and finally check by means of a few core-drill holes.

Where the strata are vertical, or nearly so, naturally the well-drill, capable of drilling only vertical holes, is not applicable, nor should core-drill holes be put down vertically, as in either case only a thickness of rock the diameter of the hole is proved.

In Fig. 12 are shown conditions where vertical holes put down by either well- or core-drill are of little use. It would seem as though such a situation would be universally understood, but, strange to say, several cases of this kind, where prospecting by vertical drilling in practically vertical beds was done, have come under the writer's observations. With the hole throughout the entire depth largely, if not entirely, confined to one bed, the amount of information obtained is negligible and of little more value than could be obtained from the outcrop.

Naturally, under conditions of steeply-dipping or vertical beds the character of the strata can be obtained only by inclined holes. If the holes can be driven at right angles to the bedding planes, the maximum number of beds will be penetrated and that means the maximum amount of useful information with the minimum amount of drilling. Where the surface is flat and the beds dip steeply, as shown in Fig. 13, it is generally advisable to drill the holes at an angle of about 30 deg., less if the rocks are fresh just beneath the soil cover, or at a steeper angle if there is a considerable depth of decomposed rock. There are two reasons for doing this. First, it is generally regarded as better not to extend the holes to a vertical depth much greater than the proposed quarry depth, simply because the information sought concerns only the stone that will eventually be quarried. Accordingly, the angle should not be too steep. The objection to having the hole only slightly inclined is that much of its length will be close to the surface and rather largely in stone that may have been affected by surface weathering.

In starting a new diamond-drill hole it is advisable to locate it so that a few feet of strata previously cut at depth will also be sampled in the beginning of the next hole. This is desirable as a check in certain cases, and in other cases is useful because the first few feet cut pass through decomposed stone not representative of the same beds in depth.

The prospecting of strata either greatly folded or faulted is difficult. Perhaps some particular bed may be recognized, if it is cut more than once in the same hole, but in limestones it is seldom possible definitely to recognize individual beds in the core samples when they are cut more than once. By noting the angle at which the strata are cut throughout the entire hole and later comparing the results with the data from other holes the true structure may be worked out. It generally requires both skill and patience. If the underground structure is as complexly folded as the beds shown in the quarry wall of Fig. 2, it becomes impossible to decipher the character of the folding from the cores, and the average composition of the entire holes must be considered in reaching an opinion as to whether the stone is desirable or otherwise. If the results show that it is on the margin of usefulness, it is extremely risky to plan to open a quarry unless the amount of drilling done is excessive by having holes spaced at very close intervals.

Representation of Results.—After results have been obtained there are many methods for recording them. The writer has used many graphic

(Continued on page 40)

Aggregates-Code Representatives Plead for Price and Output Control

Limitation on New Capital Essential to Recovery of Capital-Goods Industries

PRICE and production control and limitation of new capital going into the "durables industries"—as distinguished from the "perishables industries"—are essential to the welfare of the former, Otho M. Graves, chairman of the Code Authority of the crushed-stone, sand-and-gravel and slag industries declared at the national gathering of code authorities in Washington, March 7.

Expressing complete accord with the statement that more jobs and higher wages will increase the purchasing power in the field of perishables and like commodities, he declared: "In the durable-goods industry there is no immediate effect of increased purchasing power."

Continuing Mr. Graves said:

"It makes no difference how much purchasing power is increased, durable goods are not going to be purchased in any greater degree. Now, with the government pouring its billions of dollars into the capital-goods industry, the time is approaching, and we can see the handwriting on the wall, when that will have to stop, and the only thing to replace it is an inflow of private capital to take its place. What is going to lure this private capital into the capital-goods industry? Only one thing, profit, and opportunity of profit.

"If we can hold out some opportunity of profit in the capital-goods industries, private capital will immediately flow in and for no other reason. There is no compulsion about it, and it won't let go of itself. The money situation is unquestionably relieved to to some extent now, if money is released. What will cause its release other than profit, I do not know. That certainly will; that is, the opportunity for profit.

"That opportunity can be created in two ways. One is by some means of intelligent price control or cost control; the second by some form of limitation of production.

"The limitation of new capital is as necessary an adjunct to recovery of the capital-goods industries as is some form of price control. A limitation of new invested capital in this capital-goods industry or in the extension or enlargement of productive facilities, I submit to you, is necessary, intelligently applied. Now, I recognize that any talk of limitation of production control is un-American, essentially so. We resent it. We want to feel free to invest our money in any industry, at any place that we determine is wise and proper. That is our right in normal times, but these are not normal.

"Is it monopolistic? In all the industries which I represent, to my mind a monopoly is not a threat. As regards the federal government and all its political subdivisions, state, city, county, township, they are at liberty to go into it without restriction or restraint of code, at any time or place they please. There is no tendency toward monopoly. I submit to you that it does not tend to retard or hold back inventive genius.

"If the durable-goods industries knew they would be protected against vicious and harmful competition, which has so wrecked them and brought them into the chaotic conditions from which they are suffering to-day, there would be a flow of capital toward increased improvements, and the codes with which I am familiar state that nothing in the section shall be construed as in any sense preventing the lowering of costs or the improving of the methods of operation.

"Of course that must be so. No manufacturer should or would, except under direct compulsion, sign away his right to lower his cost of production. I submit to you that reasonable and intelligent restriction of the entrance of new capital into the durable-goods industries, with some reasonable price control is not monopolistic, if intelligently exerted. It does not destroy inventive genius, but rather promotes it, and in this moment of the direst extremity this Nation has ever experienced, such steps, intelligently, carefully administered, and removed when the opportunity for removal first shows itself, is our greatest need to-day."

Charging that, with the exception of the expressed desire of the representatives of organized labor to coöperate, "there has been little if any consideration given by the N. R. A. looking toward the rehabilitation of the industry," E. Guy Sutton, also a member of the mineral-aggregates Code Authority, said that what "meager hope" of relief and been promised by the open-price provisions of the code, was now being attacked "by selfish interests and shortsighted theorists."

The opposition to the open-price policy, he said, was apparently based on the erroneous assumption that uniformity of price is *prima facie* evidence that such prices are unreasonable. He pointed out that because certain industries may, in their enthusiasm, have attempted to abuse the open-price policy, all industries that propose to establish such a plan are forthwith indicted and without a hearing are "adjudged guilty."

He stated that if industry is to assume the responsibility that the President and the officials of the N. R. A. have placed upon it, some way must be devised whereby industry may be properly and quickly financed to meet this obligation.

"Purely patriotic duty is not a sufficient incentive, and, furthermore, pay-rolls are not met by emotionalism," he said.

Mr. Sutton said that in seeking a way out industry pretty generally has turned to the open-price policy as the best method of accomplishing the desired end. He contended that any abuse of the plan, even if it were attempted, could not long endure in the face of the possibility of a reduction of consumption, governmental supervision through representation on code authorities, and the force of public opinion.

For an example Mr. Sutton pointed out that a representative of the retail stores had very ably presented his opposition to the open-price policy because it might not be to the best and most profitable interests of his constituents, despite the fact that retailers work under the most effective open-price policy that could be devised.

H. V. Owens, of the mineral-aggregates Code Authority, said the federal government should not cease its efforts to stimulate public works. It should also bring pressure to bear on states and other governmental units to resume public-works activities and thus stimulate construction, he declared, explaining that private industry is overbuilt at present.

At the N. R. A. Code Conference of Trade Practices Robert T. Winn, counsel for the code authorities of the limestone and sandstone industries, urged the necessity of the "waiting period" in the open-price system.

The waiting period in the limestone code is 6 days, and the same period is proposed for the sandstone code, which has not yet been approved. Mr. Winn insisted that if this waiting period is struck out of the code, "the smaller units of the industry" will "disappear from the economic life of the nation."

Mr. Winn pointed out that, particularly in a fabricating industry, this period is needed to insure fair competition between those fabricators who either manufacture or produce their own material and those who are dependent upon others for the material which they use.

"There are in this country certain organizations devoted to the supply of building stone," he explained, "which are termed quarrier fabricators. There are also fabricators who have no source of supply other than these fabricators who own quarries."

He then pointed out how the quarrier fabricator, in bidding on contracts, could invariably underbid the independent fabricator, because of the fact that he would charge himself less for the raw stone than he would the man who was the owner of a cut-stone plant.

A burst of applause met Mr. Winn's statement when he told the chairman of the meeting that "the waiting period, at least for some industries, and in all cases where you have a fabrication industry and the type of competition which we have in this industry, must be included in the codes if the purposes of the N. R. A. are to be accomplished."

Identifying himself as one of the larger producers in the concrete-masonry industry, Howard Brooke, of the Bergin Building Block Co. of New Jersey, said the concrete industry is composed largely of small units, which constitute about 60 per cent. of the total number engaged. The competition which these smaller units give to the larger units, he said, is "ruinous" because they sell without regard to cost, do not restrict themselves to maximum hours, are not responsible financially, and do not comply with code provisions.

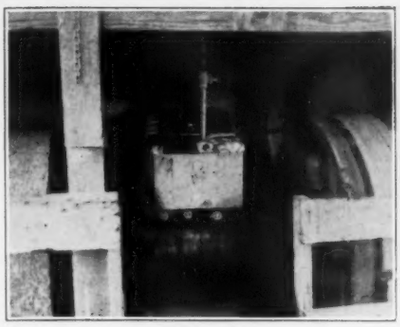
Mr. Brooke explained that the amount of their production is not known and is difficult to obtain. Furthermore, he added, the code as drafted has been found inadequate to control this faction of the industry. The code authority needs the support of N. R. A. in the collection of dues from these members, he said.

Robert H. Gamble, Jacksonville, Fla., brick and tile manufacturer, speaking to the gathering of code authorities for small industries, said the number of plants in his group increased from 1,085 to 1,600 in less than four months of code operation. Of these plants 90 per cent. are "small industries."

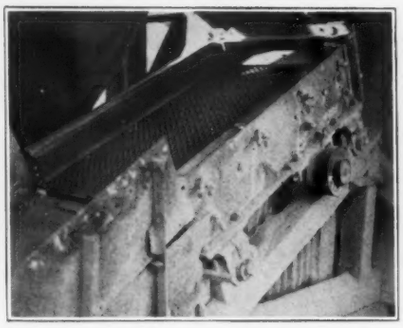
Mr. Gamble suggested that the brick-and-tile code be used as a model for the adjustment of N. R. A. difficulties in equalizing the differences, from a competitive standpoint, which exist between large and small industries. He said:

"The consumers' complaints have been singularly absent under the operation of the clay-products code and therefore I present for your consideration a code representing a large majority of small enterprises within itself, which code so adequately functions that the large manufacturer and the small manufacturer have been able to meet on a basis favorable to both and imposing no penalties upon either. Using such successful codes as a measuring stick, it would seem to be not an impractical task to remodel other codes wherein inequities exist, if there are any in fact, so that a favorable relationship will come to both large and small enterprise. I submit that only by operation under a code can the rights of all be determined insofar as their value relates to each other.

"If the N. R. A. is looked upon by industry, not in the light of a stern parent, but rather as a business partner, ready, willing, and anxious as it truly is to help, but compelled to follow the terms of the recovery act on the one hand and impelled by a desire on the other to average the rights of all rather than to consider the rights of any particular group, then and then only, I believe, will your problems receive the full measure of adjustment to which they are entitled."



One of the two jaw primary crushers.



The single-deck scalping screen.

The rotary scrubber and screen.

Primary Crusher Also Used for Reduction in New York Crushed-Stone Plant

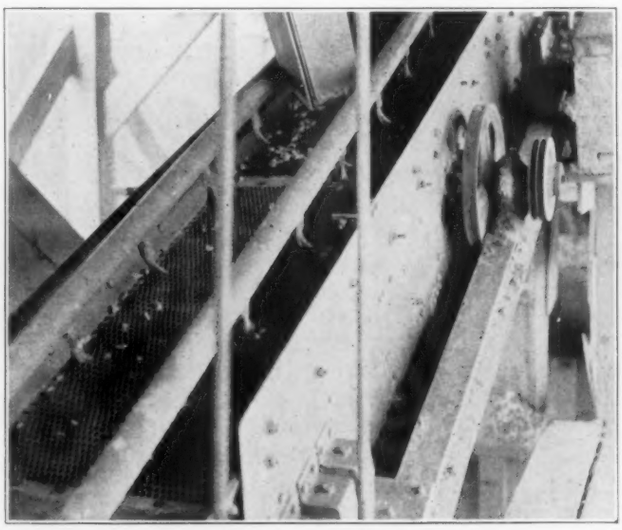
Screens Arranged to Provide Wide Variety of Sizes of Materials

A QUARRY level considerably above the plant level, an unusual arrangement of crushing and screening equipment, and the use of perforated screen plate on its vibrating screens are the points of major interest in a crushed-stone plant near Springfield, N. Y. This plant, which has a capacity of 50 tons per hr. and went into operation in April, 1933, is owned by Otsego Quarries, Inc.

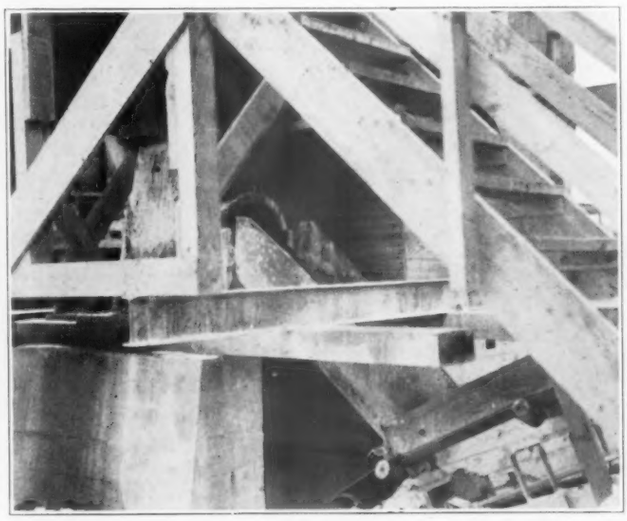
The limestone quarry is near the top of one of the many hills in this region and is at a higher elevation than most of the local stone. The deposit is about 40 ft. in depth but has been quarried to a depth of only 10 ft. The overburden varies from 6 in. to 3 ft. in thickness and is removed periodically with the quarry equipment. A Loomis 6-in. gasoline-engine-driven well-drill is used for blast holes, shots being made with Hercules 60-per cent. quarry gelatin and Cordeau. Gilman jackhammers are used for secondary drilling.

A Koehring 1-cu.yd. gasoline-engine crawler shovel loads the rock into three 3½-cu.yd. trucks, one Packard and two Whites. These haul it a distance of about 150 ft. where they unload into either of two Acme jaw crushers which are set side by side at the quarry level. One is a 32-in. by 16-in. unit and the other is a 32-in. by 10-in. machine. The demand for large sizes in this region makes it necessary to use both as primary crushers part of the time but only the larger machine is ordinarily used for this purpose. These crushers are belt-driven by 75-hp. and 50-hp. motors.

The 32-in. by 16-in. primary crusher discharges on a 30-in. inclined belt-conveyor which runs on 120-ft. centers and unloads on a 3-ft. by 8-ft. Niagara single-deck vibrating scalping screen at the top of the screening-and-storage building. This screen has wire cloth with 2¼-in. openings. The rejects can drop on an 18-in. belt-conveyor which is set on 110-ft. centers and returns the material to the 32-in. by 10-in. primary crusher, or by chute to



A double-deck vibrating screen with perforated plate and spray nozzles.



The gearless gyratory recrusher with return conveyor to screens at right.

Plant of Otsego Quarries, Inc. Crushers at left are at quarry level.

a No. 25 Kennedy-Van Saun gearless gyratory crusher which is driven by a built-in synchronous motor. This crusher discharges to a belt-conveyor, 18 in. wide and 55 ft. long between centers, which in turn feeds the main belt-conveyor running from the primary crushers.

The undersize or material from this scalping screen is discharged to a 36-in. by 18-ft. Telsmith rotary scrubber screen. This has perforated plate with 1-in. square opening on its main barrel and ⅝-in. square perforations on its jacket. The ⅝-in. to 1-in. material (No. 2 stone) is chuted to storage. The plus 1-in. material goes to a 2-ft. by 10-ft. double-deck Niagara vibrating screen having 1⅞-in.-opening Hendrick perforated plate on the top deck and 2¼-in. openings on the bottom deck. The sizes of material retained on these two decks, Nos. 3a and 3 stone, are chuted direct to storage. Material passing through the bottom deck is wasted. The minus ⅝-in. material from the revolving screen goes to a 2-ft. by 10-ft. Niagara vibrating screen which has ¼-in. and ⅛-in. Hendrick perforated plate on its two decks. The Nos. 1 and 1a materials coming from this screen go to storage and the minus ⅛-in. or sand to a settling basin. The 1a material is finding a growing use for highway retreading and maintenance work.

The storage-bin is of steel-braced timber construction with concrete foundation. It is divided into 5 compartments having a combined capacity of 1,000 tons. Chutes are arranged so that material of any of the five sizes stored can be fed by gravity to the Kennedy-Van Saun crusher for further reduction. Gates on each side of the bin allow the loading of trucks for shipment. Trucks are weighed on a 20-ton capacity Fairbanks scale at the plant office. Some material is stock-piled and this is loaded into trucks with a Barber-Greene stock-pile loader.

The main conveyor in this plant is belt-driven by a 15-hp. motor, and the other two conveyors are driven by 5-hp. motors, one through Morse chain and the other through gears. The three vibrating screens are driven by 5-hp. motors through Dayton Cog belts and the rotary screen by a 15-hp. motor through Texrope.

Wash-water for the plant is supplied at the rate of 1,000 gal. per min. by a Goulds 6-in. centrifugal pump driven by a 50-hp. motor. One hundred and twenty fan-spray type nozzles are used on the four screens in this plant. Air for the drilling operations is supplied by a Sullivan 8-in. by 10-in. air-compressor which is driven by a 25-hp. motor.

The officers of Otsego Quarries, Inc., which was formed in January, 1932, are: L. B. Gray, president; C. A. Powers, vice-president; and R. F. Kelly, secretary and treasurer. Although owned by this company the plant is being operated under lease by Eastern Rock Products, Inc., Utica, N. Y. George Grant is plant superintendent. The plant was designed by the company and erected by its own forces.

Gravel Plant *(from page 28)*

Another board controls the scalping and crushing equipment and push-button switches control the main conveyor and sizing screens. Samples are taken at regular intervals at the loading conveyor and are tested especially for grading. A telephone system connecting the test room with the operator at the bottom of the control tower makes it possible to exercise rigid control over the mixing of sizes for desired gradings.

Electric power for the plant is purchased at 33,000 v. and is reduced by three transformers at an outdoor substation to 440 v. for all plant motors. A further reduction to 110 v. is made for lighting. Water for the washing screens is obtained from a concrete-lined well under the unloading plant by a 12-in. centrifugal pump driven by a 200-hp. electric motor. This pump supplies 4,000 gal. per min. against an 80-ft. head.

A completely-equipped machine and repair shop at the plant contains a power drill, circular saw, this equipment and for other purposes. An electric-welding set is used in this shop and about the plant and dredge.

The main office of the Missouri Portland Cement Co. is at 1010 Pine St., St. Louis, Mo. Richard G. Uhlig is general superintendent, and George Ross is superintendent of the sand-and-gravel plants.

Cement Geology *(from page 36)*

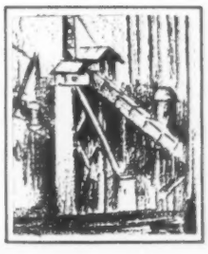
methods for presenting as accurate a picture as possible and in a way by which the essential points can be easily grasped. One of these is shown in Fig. 14.

After all is said, the services of a geologist in the cement industry are needed solely for the purpose of enabling the company concerned to obtain the raw materials necessary with the least expenditure of money and effort. Geological training and experience, plus common sense and a keen appreciation of the economics of the industry, are the requisites. A lack of any one of these attributes may be serious. Geologists are always glad to have an opportunity to prove the practical worth of their profession.

MEN OF THE INDUSTRY

M. MOSS ALEXANDER

M. MOSS ALEXANDER was elected to the presidency of the Missouri Portland Cement Co., St. Louis, Mo., on February 20, 1934, succeeding the late H. L. Block. He is one of the youngest men to have reached such a high office in the cement industry. He was born at Fayette, Mo., in 1896, but his parents moved to Oklahoma that same year. After completing his schooling he was engaged in the flour-milling industry for several years before becoming associated with the Oklahoma Portland Cement Co. of which he became general sales manager after serving in various other capacities. He joined the Missouri Portland Cement Co. as sales manager January 1, 1930, and subsequently has held positions of general sales manager and first vice-president.



Personal Mention

Otho M. Graves, chairman of the Code Authority of the crushed-stone, sand-and-gravel and slag industries, has given up his membership on the Board of Directors and the Executive Committee of the National Crushed Stone Assn.

C. R. MacFetridge has been appointed general superintendent of the Brunner Mond, Canada, Ltd., plant at Amherstburg, Ont., succeeding **Frederick Nill** who has been transferred to the Solvay Process Co., Detroit, Mich., where he will be in charge of the caustic soda and limestone operations.

Bruce C. Matson has been appointed sales manager for the Innerkip Lime & Stone Co., Woodstock, Ont. His office will be at 1501 Permanent Bldg., Toronto, Ont.

Oliver S. Kelly has been appointed direct factory representative for the Hercules Motors Corp., Canton, O., on the Pacific Coast. He will make his offices in San Francisco, Cal.

J. F. Roche, executive vice president of the Binks Mfg. Co., Chicago, Ill., has been appointed one of the members of the State Advisory Board of the National Emergency Council.

J. F. Roche

B. F. Bilsland has been appointed manager of the Chicago District office of the Allis-Chalmers Mfg. Co., at 20 N. Wacker Drive, Chicago, Ill.

Arch J. Cooper has been appointed assistant manager of the New York District office, 50 Church St., New York City, of which **A. F. Rolf** is manager.

V. D. Hawkins, a special representative of the Dewey Portland Cement Co., at Topeka, Kans., recently announced his candidacy for the Democratic nomination for governor of the state of Kansas. He has been active in politics for many years and has been in charge of his firm's contract work in that state for 14 years.

Harry J. Blose, construction foreman at the Hudson, N. Y. plant of the Universal Atlas Cement Co., was recently admitted to the Silver Medal Club of that company in recognition of his 25 years of service. The medal was presented by **Richard A. Dittmar,** superintendent. Mr. Blose became the twentieth member of the club.

Wilbur G. Hudson has been appointed chief engineer of the Link-Belt Co's. Pershing Road plant, Chicago, Ill. He is a graduate of Cornell University and has had a wide experience in materials handling, engineering, general contracting and other fields of a similar nature.

F. E. Harrell has been made assistant chief engineer of the Reliance Electric & Eng. Co., Cleveland, O. **J. L. Van Nort,** formerly in the New England and Cincinnati districts is now with the Chicago office of this company.

C. Walter Seiler has been appointed manager of the Champion Sand & Gravel Co., Iron Mountain, Mich., which operates four plants in that state.

Obituary

Hugh Lowden, 61, engineer and advertising manager of the Colorado Iron Works Co., Denver, Colo., died recently.

Capt. Harvey L. Shotwell died at the U. S. Marine Hospital, Buffalo, N. Y., on Nov. 24, 1933, after a brief illness of pneumonia. We are requested to make this late announcement because of the widely scattered acquaintanceship of Capt. Shotwell, many of whose friends may not yet have learned of his passing. He spent the greater part of his active life in dredging operations, largely in command of fleet operations on the Great Lakes.

Walter D'Arcy Ryan, 63, consulting engineer of the General Electric Co., died at his home in Schenectady, N. Y., March 14, of heart trouble. Mr. Ryan was regarded as one of the outstanding illuminating engineers, his latest achievement having been the illumination of the 1933 Century of Progress Exposition in Chicago. He had also been in charge of the illumination of the Panama-Pacific International Exposition in San Francisco in 1915. Mr. Ryan had been for 35 years director of the General Electric Co.'s illuminating engineering laboratory.

Frank Million, 35, formerly engaged with his father, the late Floyd Million, in the operation of the Million Gravel Co., Lake Cicotte, Ind., died March 7 at a hospital in Gary, Ind., of pneumonia.

C. S. Norton, 75, former president of the C. S. Norton Blue Stone Co., which he founded in 1888, died March 12 at a hospital in Miami, Fla., following an emergency operation.

Fred E. Fenton, 56, assistant treasurer of the Hercules Powder Co., died at his home in Wilmington, Del., March 13, after a long illness.

Frank J. McGanney, 65, former manager of the Salt Lake territory for the Hercules Powder Co., died of heart failure March 12, in Salt Lake City, Utah.

Edwin Struckmann, 32, general superintendent of the western division of the International Cement Corp., died March 15 of a heart attack in a theater in Kansas City, Mo. Mr. Struckmann had a long experience in the cement industry and held degrees in engineering from several European universities. His death follows by only four months that of his brother, Holger Struckmann, former president of the company.

Paul Roberts, 46, vice-president of the Southern Marble Stone Co., Atlanta, Ga., died at his home in that city Feb. 28, after a long illness.

A. N. Shearman, 62, founder of the Shearman Concrete Pipe Co., died at his home in Knoxville, Tenn., March 3, of a heart attack. This company, which has its main office in Knoxville, operates eight plants in the south and southwest.

Calcium Chloride Assn. Moves to Larger Quarters

The Calcium Chloride Assn. has moved to new and larger quarters at 2075 Penobscot Bldg., Detroit, Mich., according to a recent announcement by Ray A. Giddings, secretary. The expanding activities and increased staff of the association made this change necessary. B. C. Tiney, former highway engineer, has been named chief engineer of the association and Fred Burggraf is now soils engineer. Members of the association are: Columbia Alkali Corp., Dow Chemical Co., Michigan Alkali Co., and Solvay Process Co.

Ten Year Safety Record in Explosives Rail Shipment

The annual report of the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles, just published, shows that for the tenth consecutive year the railroads of the United States and Canada have carried dynamite and black powder without a person being killed or injured. In normal times the amount of these explosives carried reached an aggregate of more than 400,000,000 lb.

This is regarded as the most important safety record ever made in the transportation of dynamite and blasting powder. This bureau was formed in 1906 under the auspices of the American Railway Assn. The record has been made possible by an intensive campaign of education among railroad employes and by constant supervision and enforcement of rules by the officials of the bureau.

P.C.A. Indianapolis Office is Under H. J. McDargh

The Portland Cement Assn., Chicago, Ill., announces the reöpening of its offices at 610 Merchants' Bank Bldg., Indianapolis, Ind. H. J. McDargh has been appointed district engineer and will have as assistants four field engineers, C. L. Wagoner, M. S. Evans, H. Kenworthy, and L. C. Miller.

Consol. Rock Products Net Loss Lower in 1933

At a recent meeting the board of directors of the Consolidated Rock Products Co., Los Angeles, Cal., elected the following directors: Harry Bauer, Garrettson Dulin, Geo. A. Rogers, F. B. Badgley, Paul R. Watkins, Nels Gross, I. Eisner, Preston Hotchkiss, W. P. Jeffries, Frank Gautier and H. H. Cotton.

The annual report of the company showed a tonnage of 1,958,720 tons sold in 1933 as compared with 2,480,799 tons in 1932. The 1933 business was about one-third that of 1929, its first year of business. In spite of the decline in tonnage from the previous year the net loss in 1933 was only $398,655 compared to $589,458 in 1932.

Aggregates Statistics

By H. H. HUGHES, K. G. WARNER, M. ALLAN, and A. T. COONS
Bureau of Mines, Department of Commerce

THE upturn in construction toward the end of 1933 came too late to be reflected in increased shipments of building materials during the year. According to I. C. C. data, summarized in Table I, railway shipments of sand and gravel from October to December, 1933, dropped 16.4 per cent. from those of 1932. Crushed stone shipments declined even more, with a drop of 21.2 per cent., but slag shipments increased 0.9 per cent. Conditions locally showed some improvement late in the year, for fourth-quarter barge shipments of sand and gravel in the Pittsburgh district increased 34.1 per cent. from 1932. The total shipments of all the materials accounted for in the fourth quarter of 1933 dropped 16.1 per cent. from the corresponding period of the previous year.

In comparing shipments for the entire year of 1933 with those of 1932 even greater declines were recorded. The railway shipments of sand and gravel dropped 24.1 per cent., those of crushed stone 21.6 per cent., and those of slag 4.2 per cent. An increase of 23.2 per cent. in the quantity of sand and gravel shipped by waterways in the Pittsburgh district supplies an optimistic note, but this is overshadowed by a drop of 21.2 per cent. in the total for all the aggregates accounted for.

Regional Declines Vary.—The decline in the railway shipments of aggregates in 1933 was common to the entire country, although the actual decreases ranged from 10.4 per cent. in New England to 54.2 per cent. in the Northwest. Sand-and-gravel shipments increased in New England in 1933, but declines were recorded for both crushed stone and sand and gravel throughout all the other regions. Slag shipments increased 8.1 per cent. in the Central Eastern Region, the most important, but dropped 44.2 per cent. in the Great Lakes Region, the second most important. Details are given in Table II and are shown graphically in Fig. 2.

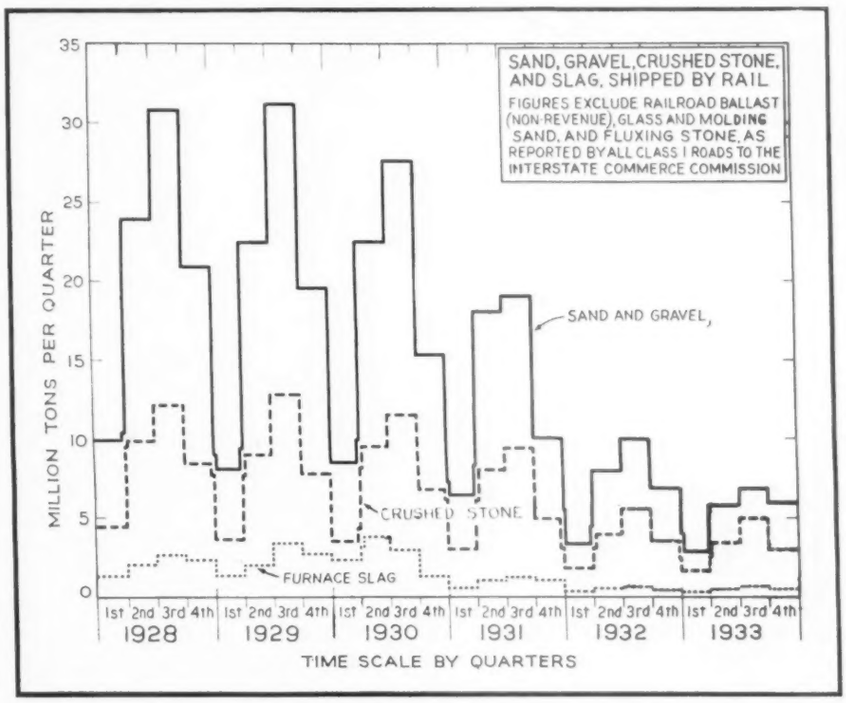


Fig. 1. Quarterly trends in railway movement of aggregates as indicated by revenue shipments.

Table I—SUMMARY OF MOVEMENTS OF AGGREGATES MATERIALS AND INDICATORS OF THEIR MARKETS IN THE FOURTH QUARTER OF 1933

	Fourth Quarter			Calendar Year to December 31		
	1932 October-December	1933 *a* October-December	Change From 1932 *(per cent)*	1932	1933 *a*	Change From 1932 *(per cent)*
Railway shipments, Class I roads *b* (excludes non-revenue railroad ballast)						
Sand and gravel *c* *short tons*	6,997,294	5,849,233	−16.4	28,764,827	21,818,298	−24.1
Crushed stone *d* *short tons*	3,804,325	2,996,565	−21.2	15,348,182	12,033,898	−21.6
Furnace slag *short tons*	492,516	496,901	+ 0.9	2,105,221	2,015,995	− 4.2
Water shipments, Pittsburgh district *e*						
Sand and gravel *short tons*	275,735	369,708	+34.1	1,250,459	1,540,480	+23.2
Total aggregates accounted for *short tons*	11,569,870	9,712,407	−16.1	47,468,689	37,408,671	−21.2
General business activity						
Portland cement shipments *f* *bbl.*	16,360,000	14,951,000	− 8.6	80,843,187	64,086,000	−20.7
Indicated domestic demand, petroleum asphalt *g* *short tons*	526,294	480,328	− 8.7	2,295,326	2,059,146	−10.3
Index of industrial production *h* *index numbers*	64.0	73.0	+14.1	64.0	76.0	+18.8
Highway construction, concrete pavement contract awards *i*						
Total, monthly average *sq. yd.*	6,788,000	6,477,000	− 4.6	8,069,000	3,761,000	−53.4
Roads only, monthly average *sq. yd*	5,966,000	4,896,000	−17.9	7,199,000	3,095,000	−57.0
Building construction contract awards						
Total value, monthly average *j*	$ 97,998,000	$171,639,000	+75.1	$112,613,000	$104,717,000	− 7.0
Residential, floor space, monthly average *j* *sq. ft.*	4,970,000	6,397,000	+28.7	6,134,000	6,066,000	− 1.1
Engineering construction, value, monthly average *k*	$101,538,000	$130,543,000	+28.6	$101,609,000	$89,031,000	−12.4

a Figures for 1933 may be subject to revision. *b* Interstate Commerce Commission. *c* Excludes glass and molding sand. *d* Excludes fluxing stone. *e* Chief Statistician, Board of Engineers for Rivers and Harbors *f* B. W. Bagley, U. S. Bureau of Mines. *g* A. H. Redfield, U. S. Bureau of Mines. *h* Federal Reserve Board; 1923-1925 average=100. *i* Portland Cement Assn. *j* F. W. Dodge Corp. *k Engineering News-Record.*

Cement and Asphalt Decline.—Other data shown in Table I help to explain the decline in the railway traffic in aggregates. The total shipments of Portland cement from the mills during 1933 dropped 20.7 per cent. from those of 1932. Past experience reveals a close correlation between the consumption of aggregates and that of cement. Large tonnages of aggregates also are used with asphalt in making bituminous roads and, to a lesser extent, in the roofing trades. The indicated domestic demand for asphalt during 1933 was 10.3 per cent. below that of 1932. With the demand for both cement and asphalt lower in 1933 than in 1932, it is logical to expect a comparable decrease in the output of crushed stone, sand and gravel, and slag.

Industrial Production Rises.—Activity in the building-materials markets fell far below the general business

activity in the country during 1933. The Federal Reserve Board index of industrial production maintained throughout the year an average level 18.8 per cent. higher than that of 1932. This was brought about by a sharp rise during the late spring and early summer, followed by a slight recession toward the end of the year. The average index for the fourth quarter of 1933, however, was 14.1 per cent. higher than that of 1932.

Highway Construction.—The volume of concrete-pavement contracts awarded during 1933 dropped 54.4 per cent. from the 1932 figure. With concrete paving amounting to less than one-half of the total of the previous year it is evident that cement and aggregates shipments must have fallen materially. Toward the end of the year conditions improved to some extent, and awards for the fourth quarter of 1933 were only 4.6 per cent. lower than those of the same quarter of 1932.

Building Construction.—The impetus of the public-works program raised the value of contracts awarded during the fourth quarter of 1933 to a level 75.1 per cent. higher than that of 1932. The total for the year, however, registered a decline of 7.0 per cent. The floor space of residential contracts increased 28.7 per cent. in the fourth quarter but dropped 1.1 per cent. for the year. Engineering construction also was 28.6 per cent. higher in the last quarter, but the total awards were 12.4 per cent. lower than those for 1932.

Estimate of 1933 Production.—Three lines of evidence are available to aid in estimating the output of sand and gravel, and crushed stone in 1933. They are railroad shipments, market indicators, and partial returns from producers.

Railway shipments of sand and gravel dropped 24.1 per cent. in 1933, cement shipments 20.7 per cent., building construction 7.0 per cent., and concrete paving 53.4 per cent. From these data it seems reasonable that sand-and-gravel production must have dropped about 20 per cent. from 1932 to 1933. A study of the production schedules already returned by operators shows that the companies that produced 32 per cent. of the total in 1932 reported 19 per cent. less material in 1933.

Glass- and molding-sand producers, however, enjoyed better business. Glass-sand operators who accounted for 71 per cent. of the 1932 total reported 30 per cent. higher sales in 1933. Returns from molding-sand producers who reported 37 per cent. of the 1932 output indicate an increase of 65 per cent. in 1933. The increases shown by these sample returns are substantiated by indicators of activity in the glass and foundry industries, published in detail last month.

The demand for railroad ballast apparently fell about 10 per cent. compared with 1932.

On the basis of these data it is estimated that the commercial production of sand and gravel in 1933, including glass and molding sand and railroad ballast, amounted to about 71,000,000 short tons, compared with 85,289,076 short tons in 1932. It is impossible to estimate how closely noncommercial production may have approximated the total of 34,748,821 short tons in 1932. If 35,000,000 short tons is taken as a logical guess, the total sand-and-gravel output in 1933 was about 106,000,000 short tons, compared with a total of 120,037,897 short tons in 1932.

Producers of sand and gravel were encouraged by better prices. Preliminary returns indicate that the unit value, f.o.b. plant, increased about 10 per cent. over that of 1932. Glass-sand values showed a rise of 2 per cent., whereas molding sand apparently remained unchanged.

Railway shipments of crushed stone dropped 21.6 per cent. in 1933, which

(*Continued on page 50*)

Table II—SUMMARY OF RAILWAY SHIPMENTS OF AGGREGATES IN THE FOURTH QUARTER OF 1933, BY REGIONS (*short tons*) *a*

	Fourth Quarter			Calendar Year to December 31		
	1932 October-December	1933 *b* October-December	Change From 1932 (*per cent*)	1932	1933 *b*	Change From 1932 (*per cent*)
New England:						
Sand and gravel	42,077	53,223	+26.5	127,108	161,966	+27.4
Crushed stone	95,319	56,413	−40.8	512,126	410,734	−19.8
Furnace slag		66		87	92	+ 5.7
Total	137,396	109,702	−20.2	639,321	572,792	−10.4
Great Lakes:						
Sand and gravel	733,662	589,159	−19.7	2,880,652	2,165,983	−24.8
Crushed stone	412,216	298,604	−27.6	2,146,395	1,397,716	−34.9
Furnace slag	100,467	46,700	−53.5	506,307	282,674	−44.2
Total	1,246,345	934,463	−25.0	5,533,354	3,846,373	−30.5
Central Eastern:						
Sand and gravel	993,585	757,989	−23.7	3,789,237	2,944,846	−22.3
Crushed stone	753,085	519,235	−31.1	3,047,329	2,432,729	−20.2
Furnace slag	289,288	334,190	+15.5	1,137,424	1,229,128	+ 8.1
Total	2,035,958	1,611,414	−20.9	7,973,990	6,606,703	−17.1
Pocahontas:						
Sand and gravel	224,816	105,426	−53.1	938,862	528,512	−43.7
Crushed stone	109,607	78,151	−28.7	415,241	380,838	− 8.3
Furnace slag	10,729	25,627	+138.9	81,676	67,017	−17.9
Total	345,152	209,204	−39.4	1,435,779	976,367	−32.0
Southern:						
Sand and gravel	1,339,696	1,029,951	−23.1	4,827,816	4,129,974	−14.5
Crushed stone	938,657	894,709	− 4.7	3,612,056	3,281,293	− 9.2
Furnace slag	91,132	80,087	−12.1	363,353	401,794	+10.6
Total	2,369,485	2,004,747	−15.4	8,803,225	7,813,061	−11.2
Northwestern:						
Sand and gravel	1,050,104	731,988	−30.3	5,640,661	2,743,227	−51.4
Crushed stone	410,238	194,339	−52.6	1,553,947	550,463	−64.6
Furnace slag	391	592	+51.4	2,098	1,670	−20.4
Total	1,460,733	926,919	−36.5	7,196,706	3,295,360	−54.2
Central Western:						
Sand and gravel	1,396,216	1,597,642	+14.4	5,727,954	5,036,112	−12.1
Crushed stone	566,819	485,245	−14.4	1,933,301	1,673,913	−13.4
Furnace slag	85			394	493	+25.1
Total	1,963,120	2,082,887	+ 6.1	7,661,649	6,710,518	−12.4
Southwestern:						
Sand and gravel	1,217,138	983,855	−19.2	4,832,534	4,107,638	−15.0
Crushed stone	518,384	469,869	− 9.4	2,127,787	1,907,232	−10.4
Furnace slag	424	9,639	+2,173.3	13,882	33,898	+144.2
Total	1,735,946	1,463,363	−15.7	6,974,203	6,048,768	− 13.3

a Compiled from reports of the Interstate Commerce Commission. *b* Figures for 1933 are subject to revision.

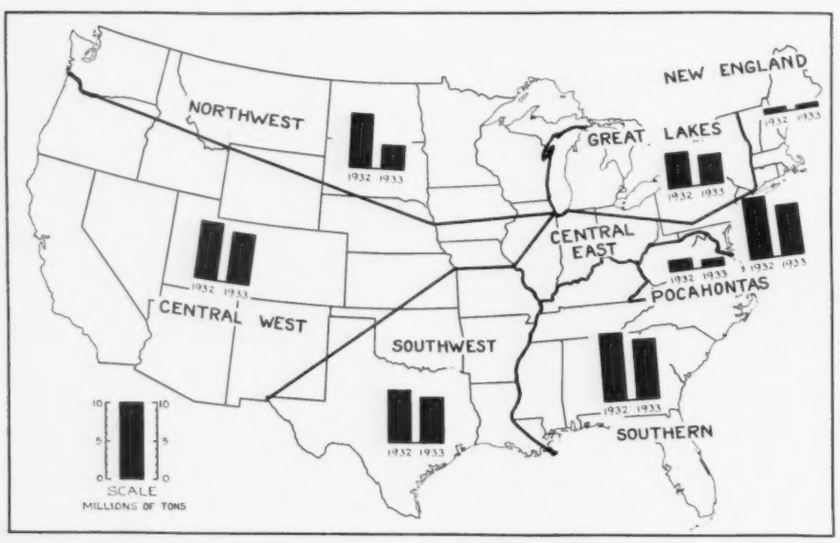


Fig. 2. Total shipments of aggregates on Class I railroads in 1932 and 1933 by regions.

Latest Portland-Cement Statistics

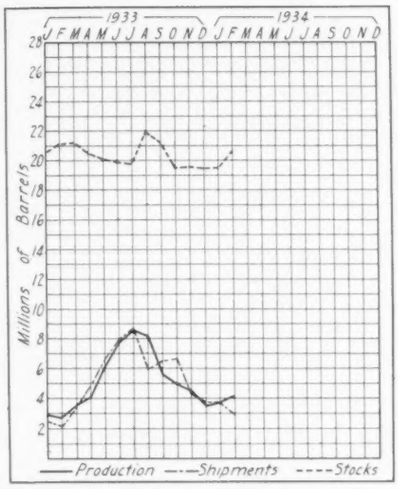


Chart showing monthly production, shipments and stocks on hand at end of month from February, 1933, to February, 1934.

THE Portland-cement industry in February, 1934, produced 4,168,000 bbl., shipped 2,952,000 bbl. from the mills, and had in stock at the end of the month 20,763,000 bbl. of cement. The production of Portland cement in February, 1934, showed an increase of 50.1 per cent. and shipments an increase of 29.6 per cent., as compared with February, 1933. Portland-cement stocks at the mills were 1.7 per cent. lower than a year ago.

In the following statement the total output of finished cement is compared with the estimated capacity of 163 plants at the close of February, 1934, and of 165 plants at the close of February, 1933.

RATIO (*per cent.*) OF PRODUCTION TO CAPACITY

	February		Jan.	Dec.	Nov.
	1933	1934	1934	1933	1933
The month..	13.4	20.2	16.6	15.5	21.2
The 12 months ended	27.1	24.4	23.9	23.6	23.9

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1933 AND 1934 (*In thousands of barrels*)

Month	Production		Shipments		Stocks At End of Month	
	1933	1934	1933	1934	1933	1934
January	2,958	3,779	2,502	3,778	20,624	*a*19,547
February	2,777	4,168	2,278	2,952	21,125	20,763
March	3,684	.....	3,510	.....	21,298	.....
April	4,183	.....	4,949	.....	20,542	.....
May	6,262	.....	6,709	.....	20,117	.....
June	7,804	.....	7,979	.....	19,936	.....
July	8,609	.....	8,697	.....	19,848	.....
August	8,223	.....	5,994	.....	22,078	.....
September	5,638	.....	6,517	.....	21,216	.....
October	5,037	.....	6,750	.....	19,502	.....
November	4,672	.....	4,463	.....	19,709	.....
December	3,526	.....	3,738	.....	*a*19,541	.....
Totals	63,373	.....	64,086	.....	.....	.....

a Revised.

DISTRIBUTION OF CEMENT (*a*)

Shipped to—	January *a*		Year		Shipped to—	January *a*		Year	
	1933	1934	1932 *b*	1933 *c*		1932 *b*	1933 *c*	1932 *b*	1933 *c*
Alabama	65,810	120,597	391,813	926,137	New Jersey	92,250	84,978	2,855,266	2,013,266
Alaska	0	396	12,536	8,335	New Mexico	10,604	17,361	173,853	193,313
Arizona	5,758	26,984	161,230	125,482	New York	299,193	227,196	11,057,189	7,143,122
Arkansas	28,702	38,826	269,691	656,851	North Carolina	20,527	59,997	434,454	485,280
California	248,865	420,939	4,683,906	4,916,724	North Dakota	3,041	7,384	175,886	132,728
Colorado	10,805	26,540	492,484	430,842	Ohio	82,682	131,995	4,812,502	2,705,329
Connecticut	26,209	24,328	807,686	734,619	Oklahoma	105,220	101,643	1,238,287	1,416,795
Delaware	8,899	8,147	297,959	251,067	Oregon	17,283	28,175	522,909	328,659
Dist. of Col	76,511	44,541	1,070,092	938,032	Pennsylvania	156,684	208,317	4,712,366	4,174,041
Florida	35,070	85,609	428,020	597,340	Porto Rico	2,588	7,700	55,328	91,519
Georgia	92,250	76,961	1,128,505	728,432	Rhode Island	5,636	10,183	305,359	280,917
Hawaii	12,946	12,756	237,406	159,759	South Carolina	7,520	26,218	367,951	214,888
Idaho	2,524	8,096	103,017	118,861	South Dakota	7,068	5,932	333,836	243,166
Illinois	71,367	133,420	5,826,307	5,276,836	Tennessee	38,976	98,058	1,176,655	955,697
Indiana	37,033	68,130	3,014,646	2,019,298	Texas	286,316	244,007	3,961,891	3,212,456
Iowa	22,087	36,582	2,592,470	1,503,894	Utah	3,281	7,739	164,305	240,800
Kansas	55,891	84,581	1,044,983	948,538	Vermont	2,259	3,741	260,191	140,288
Kentucky	30,128	55,883	1,306,388	1,271,196	Virginia	34,550	103,602	905,663	914,969
Louisiana	93,341	99,525	1,287,738	756,656	Washington	18,587	66,403	1,289,210	687,253
Maine	3,893	6,711	409,836	310,073	West Virginia	32,661	55,535	861,200	657,714
Maryland	35,046	51,441	1,556,646	819,380	Wisconsin	22,811	64,953	2,951,291	1,837,552
Massachusetts	28,508	69,993	2,125,962	1,471,654	Wyoming	3,008	5,673	82,368	82,408
Michigan	38,780	171,041	3,476,002	2,558,673	Unspecified	6,802	5,187	159,388	96,661
Minnesota	7,518	28,533	3,147,583	1,469,040		2,473,844	3,707,827	80,488,941	63,368,393
Mississippi	27,456	50,277	467,017	685,976	Foreign countries	28,156	70,173	354,246	717,607
Missouri	72,845	95,930	3,455,236	2,548,894					
Montana	6,082	11,586	150,370	162,444					
Nebraska	10,799	27,642	771,144	1,026,357	Total shipped from cement plants	2,502,000	3,778,000	80,843,187	64,086,000
Nevada	54,662	244,948	648,003	1,434,477					
New Hampshire	4,512	4,907	266,917	263,705					

a Includes estimated distribution of shipments from 2 mills in December, 1933 and in January, 1934; from 3 mills in December, 1932 and in January, 1933. *b* Final figures. *c* Compiled from monthly reports of the producers; includes estimated distribution of shipments from 2 to 4 mills each month, and some revisions.

Nonmetallic Exports Show Gain Over Imports in 1933

According to U. S. Dept. of Commerce figures there was a substantial improvement in the 1933 foreign trade in nonmetallic minerals. The value of exports rose 29 per cent. to $30,372,388, while imports rose 19 per cent. to $36,078,287.

Babcock-Wilcox Enlarge Southwestern Territory

The Babcock & Wilcox Tube Co. announces that the territory served by its Tulsa, Okla., sales office, managed by C. J. Hochenauer, has been enlarged to include the entire state of Oklahoma and the southern half of Kansas.

A. I. M. E. Elects Officers at Annual Convention

The American Institute of Mining and Metallurgical Engineers at its recent annual meeting elected the following officers: Howard N. Eavenson, president; Louis S. Cates, vice president, and Karl Eilers, treasurer. Directors, in addition to the above, are: H. A. Buehler, Charles B. Murray, Brent N. Rickard, Geo. B. Waterhouse, and William Wraith.

Landslide in Jugoslavia Quarry Kills 30 Workers

More than 30 workers were killed March 20 in a landslide in the Batignole Quarry at Banyitsa, near the Albanian border of Jugoslavia. Several days of excavation were required to recover the bodies.

U. S. Gypsum Elects Three New Directors

The United States Gypsum Co., Chicago, Ill., at a recent meeting of the board of directors elected three new directors. Solomon A. Smith, president of the Northern Trust Co., succeeds to the vacancy left by the recent death of Melvin A. Traylor; C. H. Shaver succeeds R. G. Bear, deceased; W. L. Keady succeeds C. R. Birdsey, resigned.

Activity Increasing in Tenn. Phosphate District

The phosphate industry in the vicinity of Franklin, Tenn., is reported to be showing signs of unusual activity. Most of the large producers are making preparations to step up payrolls, shipments and operations in anticipation of an increase in business which is already becoming evident. One large company is reported to have taken options on large acreage of phosphate deposits and will build a new plant at a later date. The Tennessee Valley Authority is reported to have obtained options on large pieces of property and shipments of rock to Muscle Shoals for use in the big phosphate experiment there are expected to begin soon.

Traffic News and Comment

Recent I. C. C. Decisions

Cement.—The Commission has awarded reparation on finding that the rate on cement from Speed, Ind., to Waco, Tex., was unreasonable for the past to the extent that it exceeded 36 c. and would be unreasonable for the future to the extent that it might exceed 34c. Shipments were made between July 6 and Nov. 23, 1931. The new rate is to be established not later than June 16.—I. C. C. Docket No. 26,013, Louisville Cement Co. *v.* Pennsylvania *et al.*

The protests against the suspended schedules naming rates on cement from Kenova, W. Va., to Washington, D. C., having been withdrawn, the proceeding in I. & S. Docket No. 3,869 is discontinued.

Plaster-board.—The Commission has found that the rates charged on plasterboard from Ft. Dodge, Ia., Southard, Okla., Acme and Sweetwater, Tex., to destinations in California, New Mexico, Colorado, Arizona, Nevada and Oregon, between May 25, 1930, and Jan. 14, 1932, were not unreasonable, and has dismissed the complaints in I. C. C. Dockets No. 25,553, Certainteed Products Corp. *v.* A. T. & S. F. *et al.*, and No. 25,553, Sub. 1, United States Gypsum Co. *v.* Amador Central *et al.*

Examiners' Reports

Cement.—Upon further hearing Examiner L. H. Macomber has made a report on the amounts of reparation due complainant on shipments of cement from Spocari, Ala., to destinations in Missouri, Oklahoma and Texas, following a prior finding by the Commission in 191 I. C. C. 101, that such rates were unreasonable. Among the proposals of the examiner was reparation of $32,988.39 for the movement via the Southern, N. O. & N. E. and T. & N. O. For the movement via the Southern, N. O. & N. E. and the T. & P., the proposed award is $25,583.26.—I. C. C. Docket No. 24,626, Lone Star Cement Co. of Alabama *v.* A. T. & S. F. *et al.*

Crushed Stone.—An attack on the rates on concrete aggregates from Maple Grove, O., to destinations in Michigan, and those from other points to the same destinations, alleged to create a violation of Sec. 1, 3 and 13 of the Act to Regulate Commerce and Sec. 500 of the transportation act, has brought from Examiner Myron Witters a recommendation that the complaint be dismissed. Complainants contended that the low rates published by the carriers from the Monroe-Oxford, Mich., group to Detroit, for distances less than 40 mi., which were lower than rates prescribed for such hauls by the Commission; and rates charged by boats bringing stone from northern Michigan ports to Detroit resulted in undue prejudice to interstate commerce. The examiner said that the railway rates had been reduced in an effort to meet the waterway competition and also motor-truck competition. The Commission has no jurisdiction over either truck or waterway movement, and Sec. 500 of the transportation act does not confer any additional powers on it. The mere existence of disparity between intrastate rates and interstate rates was not sufficient to warrant a finding of undue prejudice, he said. No movement of concrete aggregates from Maple Grove to distinations in Michigan was shown, nor was any evidence of the complainant making any attempt to market such aggregates in Michigan introduced. Complainants proposed that the P.S.M. 923 scale be prescribed as reasonable in Michigan for all distances over 25 mi., with the exception that the rates from the Monroe-Oxford group to Detroit should be 70 c., and ex-dock rates of 80 per cent. of the scale be prescribed for the movement of lake stone to interior points.—I. C. C. Docket No. 25,156, Basic Dolomite, Inc., *et al. v.* Ann Arbor, *et al.*

Dolomite.—On further hearing solely on the question of reparation Examiner J. J. Williams proposes that the Commission award $272.65 as the amount due under the findings in the previous report 194 I. C. C. 435, that the rate charged on dolomite shipped from Ashley Falls, Mass., to Hartford, Conn., was inapplicable.—I. C. C. Docket No. 25,481, Olds & Whipple, Inc. *v.* N. Y. N. H. & H.

Sand.—On further hearing examiner Burton Fuller recommends that the Commission find $2,553.88 as the amount of reparation due complainant under prior findings in 188 I. C. C. 99, on shipments of molding (silica) sand, from Ottawa, Ill., to Lockland, O.—I. C. C. Docket No. 21,091. Sawbrook Steel Castings Co. *v.* C. B. & Q. *et al.*

Examiner L. B. Dunn has proposed an award of reparation on finding that the rates on glass sand from Mapleton, Pa., to Olean, N. Y., were unreasonable prior to June, 1933, to the extent that they exceeded $2.20 per net ton. As rates for the future were prescribed in Industrial Sand Cases, 1930, no order for the future was necessary.—I. C. C. Docket No. 26,073.

Sand and Gravel.—Examiner L. H. Dishman recommends that the Commission find the rates charged on sand and gravel from Louisville, Neb., to Atlantic and Lorah, Ia., since June 1, 1931, not unreasonable and dismiss the complaint in I. C. C. Docket No. 26,034, C. F. Lytle Construction Co. *v.* C. R. I. & P.

Slag.—Examiner E. L. Glenn proposes an award of reparation on finding that the rate on slag from Ensley and Woodward, Ala., to Walhalla, S. C., be found unreasonable to the extent that it exceeds or may exceed $1.65 a net ton, and that this rate be prescribed for the future. Shipments moved between September, 1930, and October, 1931.—I. C. C. Docket No. 26,084, Birmingham Slag Co. *v.* Blue Ridge Ry. Co. and Southern Ry. Co.

Rate-Committee Dockets

New England Freight Assn.

Lime.—Carriers a reduction in the rate on common lime, car-load minimum weight 50,000 lb., from Ashley Falls, Lee and West Stockbridge, Mass., Canaan, Danbury, East Canaan and Falls Village, Conn., to New York (Pier 37 E. R.), N. Y., and Brooklyn stations named in N. H. I. C. C. F-3,142, from 13 c. to 12 c.—Docket No. 32,386.

Trunk Line Assn.

Crushed Stone.—Shippers propose a reduction in the rate on crushed stone and crushed stone screenings,[1] but not to include agricultural or ground limestone, fluxing stone or firestone, from Texas and Blue Mount, Md., Campbell, York, Billmyer, Bainbridge and Union Stone Co., Pa., to Hursley, Md., and Franklin City, Va., from $1.85 to $1.60 per net ton.—Docket No. 32,127.

Feldspar.—Shippers propose the establishment of a rate on feldspar from Brookneal, Va., to Bethavan, Marion and Muncie, Ind., of $5.25 per net ton.—Docket No. 32,118.

Ground Limestone.—A line of rates on ground limestone and limestone dust, carload minimum weight 50,000 lb., from Jordanville, N. Y., to D. L. & W. stations, Scranton, Pa., Owego, Ithica, Avoca, Coventry, West Winfield, South Columbia, N. Y., and various, ranging from 70 c. to $2 per net ton has been proposed by shippers. A statement of the proposed rates will be furnished on request.—Docket No. 32,078.

Shippers propose a line of rates on ground limestone, car-load minimum weight 50,000 lb., from Blakeslee, N. Y., to Erie R. R. stations, Pine City to Seeley Creek, N. Y., inclusive, Blossburg, Pa., Wayland, Lakeville, Attica, Salamanca, N. Y., and various, ranging from $1.60 to $2.35 per net ton. A statement of the proposed rates will be furnished on request.—Docket No, 32,128.

Lime.—A commodity rate of 13 c. per 100 lb. is proposed by shippers to apply on chemical lime, car-load minimum weight 30,000 lb., from Bellefonte and Pleasant Gap, Pa., to Pettys Island, N. J. The sixth class rate of 22 c. now applies. —Docket No. 32,060.

Carriers propose the establishment of rates on carbonate of lime (recarbonated waste) having value for agricultural purposes only, and packages so marked, carload minimum weight 40,000 lb., from Engle, W. Va., and York, Pa., to points in Trunk Line territory, on the basis of 1 c. per 100 lb., above the current agricultural lime rates.—Docket No. M-3,303 (Cancels Docket No. 31,458).

Mica.—Shippers propose a reduction in the rate on dry ground mica, car-load minimum weight 50,000 lb., from Rutherford, N. J., to North Tonawanda, N. Y., from 28½ c. to 21 c. per 100 lb.—Docket No. 32,100.

Central Freight Assn.

Agricultural Limestone.—Carriers propose a reduction in the rates on agricultural limestone (refuse lime) in bulk, in open-top cars, from Milltown, Ind., to Nisbet and Martin, Ind., from $1.90 to $1.10 and to Armstrong, Ind., from $1.80 to $1.10 per net ton.—Docket No. 38,875.

Carriers propose reductions in the rates on agricultural limestone, in bulk, in open-top cars only, from Bluffton, Ind.: To Cheneyville, Ill., from $1.20 to $1.08; to Paxton, Ill., from $1.25 to $1.08; to Bloomington, Ill., from $1.35 to $1.11; to Peoria, Ill., from $1.45 to $1.24 per net ton.—Docket No. 39,062.

Coated Aggregates.—Shippers have proposed a line of rates on coated crushed stone, slag and/or gravel, from Bridgeport, O., to destinations in West Virginia, Pennsylvania and Maryland, subject to the usual 10-per cent. restrictions on the oil or tar. Representative rates are shown below.—Docket No. 39,048.

To	Proposed	Present
Moundsville, W. Va.	$0.70	$0.96
Woodland, W. Va.	.80	96
Sistersville, W. Va.	1.00	1.19
Kenova, W. Va.	1.70	2.11
Washington, Pa.	1.00	1.19
Clarksburg, W. Va.	1.20	1.42
Hutton, Md.	1.40	1.76
Mt. Lake Park, Md.	1.50	1.88

Cement.—Carriers propose a reduction in the rate on cement, also on dry building mortar, in straight car-loads or in mixed car-loads with cement, car-load minimum weight 50,000 lb., from Osborn, O., to College Hill and Mt. Healthy, O., from 11 c. to 8½ c. per 100 lb.—Docket No. 38,931.

Crushed Stone.—Reduced rates per net ton on crushed stone and crushed-stone screenings in open-top cars from Bridgeport, O., to stations on the W. & L. E. are sought by shippers. Representative proposed rates are: To Steubenville, 50 c.; Mingo Jct., 50 c.; Yorkville, 50 c.; Dillonvale, 50 c.; Adena, 50 c.; Unionvale, 60 c.; Scio, 80 c.; Bowerston, 85 c.; and to Harrisville, 60 c.—Docket No. 38,913.

Shippers propose a reduction in the rate on crushed stone and related articles, from Genoa and Martin, O., to West Alliance, O., from $1.35 to $1.25 per net ton. —Docket No. 39,001.

Dolomite.—Shippers at Woodville and Gibsonburg, O., are asking for a reduction in the rate on raw dolomite in box cars to Syracuse, N. Y., to $2.50 per net ton.—Docket No. 39,005.

Roasted Dolomite.—Shippers have proposed a line of proportional rates per net ton to apply on roasted dolomite from Kellogg, Ill., on traffic originating at Bonne Terre, Mo., to destinations in C. F. A. territory. Representative proposed rates are: To Aliquippa, Pa., $3.20; to Buffalo, N. Y., $3.40; to Canton, O., $3.00; to Cleveland, O., $3.00; to Columbus, O., $2.60; to Corry, Pa., $3.40; to Detroit, Mich., $2.80; to Erie, Pa., $3.20; to Kokomo, Ind., $1.20; to Lima, O., $2.80; to Pittsburgh, Pa., $3.20; and to Youngstown, O., $3.20.—Docket No. 38,992.

Sand and Gravel.—Shippers at Ashtabula and Ashtabula Harbor, O., propose a line of rates per net ton on common sand and gravel, representative of which are: To West Liberty, Pa., $1.30; to Castle Shannon, Bennicoll, Coverdale, Horning, Bruseton and Clairton, Pa., $1.40; to Donora (Baird), and Avella, Pa., $1.50; to Republic and Connellsville, Pa., $1.60; and to Ifield, Pa., $1.70.—Docket No. 39,000.

A reduced rate of 75 c. per net ton to apply on sand and gravel from Peru, Ind., to Lucerne, Ind., is proposed by shippers.—Docket No. 39,002.

Shippers propose a reduction in the switching rate on sand and gravel between P. R. R. (main-line) points, Wheeling or Warwood, W. Va., and P. R. R. (terminal-branch) points, Benwood, W. Va., Martins Ferry, O., and Wheeling, W. Va., from 50 c. to 38 c. per gross ton, car-load minimum weight 25 gross tons.—Docket No. 39,006.

Reductions in the rates on common sand and gravel from Chicago and Joliet, Ill., are being sought by shippers. Representative proposed rates per net ton are: To Glen Lord, $1.01; to Penn, Schoolcraft, Cassopolis, Vicksburg, Dowagiac, Kalamazoo, Three Rivers, Colona, Hartford, Riverside and Watervliet, $1.20; to Battle Creek, Scotts, $1.25; to Allegan, Bangor, Dunning, Fillmore, Grand Rapids, Holland, Hudsonville Jenison, Mill Grove and Veneklassen, $1.35.—Docket No. 39,035.

Carriers propose to reduce the rate on common sand and gravel from Mantua, O., to Sharon, Pa., from $1.00 to 80 c. per net ton.—Docket No. 39,046.

Shippers at Lodi, O., propose the following rates per net ton to apply on sand and gravel to destinations in Ohio: To Wellington, Spencer, Burbank Spur, Creston, 40 c.; to White Fox, Brighton, Pawnee, Smithville, Prior, Orville, 50 c.; to Norwalk, Monroeville, Hartland, Clarksfield, 60 c.; to Milan 80 c.; to Clyde, Bellevue, Huron, 85 c. and to Fremont, 90 c.—Docket No. 39,049.

Carriers propose a reduction in the rate on sand and gravel from Marion and Richwood, O., to Marysville, O., from 85 c. to 70 c. per net ton.—Docket No. 39,054.

Illinois Freight Assn.

Cement.—It is proposed to establish proportional rates on cement, car-load minimum weight the marked capacity of the car, to Brookport and Metropolis, Ill., when destined beyond via river, from LaSalle, Ill., of 11½ c. and from Dixon, Ill., of 12½ c. per 100 lb.—Docket No. 6,592-2.

Crushed Stone, Sand and Gravel.—It is proposed to reduce the rate on all kinds of stone, sand and gravel, from Joliet, Ill., and points grouped therewith, to Waverley, Ill., from $1.13 to $1.01 per net ton.—Docket No. 7,100-S-114.

Limestone.—A reduction in the rate on limestone rock, car-load minimum weight the marked capacity of the car, but not less than 100,000 lb., from Dallas City, Ill., to Joliet, Ill., from $1.50 to $1.25 per net ton has been proposed.—Docket No. 7,532-A.

Sand.—It is proposed to establish a commodity rate on lake, river and bank sand, other than sand loam, from Calumet, Gary and Willow Creek, Ind., to Casey, Ill., of $1.70 per net ton.—Docket No. 5,502-S-1.

Western Trunk-Lines Committee

Gravel.—Shippers propose the establishment of a commodity rate on gravel or gravel pit strippings,[1] from Pacific, Mo., to Lowell, Ind., of $2.33 per net ton.—Docket No. 7,283-4.

Gypsum Rock.—The following reduced rates have been proposed to apply on gypsum rock [1] to destinations in Kansas. In every case the present rate is 8½ c. The proposed rates per 100 lb. are: From Medicine Lodge, Kan.: To Fredonia and Independence, 6½ c.; to Chanute and Humboldt, 7 c.; and to Iola, 8 c. From Sun City, Kan.; to Fredonia, Humboldt and Independence, 7 c.; to Chanute and Iola, 8 c. From Kling, Kan.; to Fredonia and Independence, 7 c.; to Chanute, Humboldt and Iola, 8 c. From Blue Rapids, Kan.: to Bonner Springs, 6 c.; to Chanute, Humboldt and Iola, 8 c. From Irving, Kan.; to Bonner Springs, 6 c.; and to Chanute, Humboldt and Iola, 8 c.—Docket No. 485-E.

Lime.—A reduction of 1½ c. per 100 lb., in the rates on lime, car-load minimum weight 30,000 lb., to C. R. I. & P. stations, Valley Jct., Ia., to Council Bluffs, Ia., and Omaha, Neb., from Springfield, Mo., to 16 c. and from Limedale Spur Ruddells and Johnsons, Ark., to 17½ c. has been proposed.—Docket No. 5,071-F Sup. 1.

Plaster.—It is proposed to establish rates on plaster as described in Item 10, W. T. L. Tariff 293, and Item 100 S. W. L. Tariff 31-J, including ground gypsum and gypsum filler, straight or mixed car-loads, car-load minimum wt. 40,000 lb., from Wichita, Kan., to all points in Kansas, Colorado, Oklahoma, Texas and New Mexico provided with rates in the above-named tariffs, the same as now apply from Medicine Lodge, Kan., except to points immediately around Wichita, a list of which will be furnished on request.—Docket No. 5,547-H.

Southern Freight Assn.

Ground Limestone.—It is proposed to publish the following reduced rates on ground or pulverized limestone, car-load minimum weight 60,000 lb., from Dugan, Ky., to Indianapolis, Ind., $2.37 and to Ft. Wayne, Ind., $2.75 per net ton.—Docket No. 4,393.

Lime.—It is proposed to reduce the rate on common, hydrated, quick or slacked lime, car-load minimum weight 50,000 lb., to California, O., from Jasper, Sherwood and Summitville to $3.06, and from Bruns, Tenn., to $2.98 per net ton.—Docket No. 4,309.

Mica.—Shippers propose a reduction in the rate on crude, scrap or waste mica from Bowditch, Burnsville and Cane Branch, N. C., to Forest Park, Ill., from 55 c. to 35 c. per 100 lb., car-load minimum weight to be 60,000 lb.—Docket No. 4,316.

Roasted Dolomite.—Carriers propose a revision of Item 410, Note B, Exceptions No. 11 to Southern Classification, Agent Dulaney's I. C. C. 50 which provides for 16 per cent. of the first-class rating on roasted dolomite,[1] to provide for 12 per cent. of the first-class rating.—Docket No. 4,482.

Sand.—Carriers propose to establish a rate on sand from Millington, Oregon, Ottawa, Utica and Wedron, Ill., to Columbus, Miss., of $3.34 per net ton.—Docket No. 4,450.

Slag.—Shippers propose the establishment of a rate on slag (except ground basic slag), granulated, lump, or pulverized, in packages or in bulk,[1] from Chicago and Chicago switching-district points including Gary, Ind., to Memphis, Tenn., of $2.80 per net ton.—Docket No. 4,420.

Talc.—It is proposed to publish a commodity rate on crude or ground soapstone or talc, car-load minimum weight 50,000 lb., from Kings Creek, S. C., to E. St. Louis, Ill., and St. Louis, Mo., of $5.81 per net ton.—Docket No. 4,296.

Southwestern Freight Bureau

Cement.—Shippers at Ada, Okla., and Okay Jct., Ark., request the establishment of the same scale of rates as contemplated in Texas, as proposed in application No. 1929 of the Texas-Louisiana Tariff Bureau. (See PIT AND QUARRY, Feb., 1934, p. 54, Docket No. 8,850-TX.) These rates are to be determined by the use of the actual short-line distances through junctions at which track connections exist. This scale of rates is to meet motor-truck competition. They are below the standard scale of rates applying to-day from Ada, Okla., and Okay Jct., Ark.—Docket No. 3,029.

Chatt.—A reduction in the rate on chats (mine gravel) from Picher, Okla., to Pryor, Okla., from 95 c. to 79 c. per net ton is requested by shippers.—Docket No. 2,968.

Crushed Stone.—To meet the competition of near producers, shippers at Carthage, Mo., request the establishment of a rate on crushed or ground limestone, as described in Item 3,590 of W. T. L. Tariff 111-H, of $3.00 to Pueblo, Colo., and $3.50 to Colorado Springs, Denver, Boulder, Greeley and Ft. Collins, Colo.—Docket No. 3,024.

Lime.—It is proposed to establish on lime to, from and within S. W. F. B. territory, Class 16 at 30,000 lb., minimum, and class 13½ at 60,000 lb., minimum, within the scope of S. W. L. Tariffs Nos. 151, 152-B, 153, 154-C, 173-E, 214 and related tariffs; all present commodity rates to be cancelled, except that commodity rates now in effect from producing points in southern Missouri, Arkansas and Watts, Okla., to points in Kansas, Missouri, Illinois and Western Trunk-Line territory be continued for readjustment later; the Class 16 and 13½ bases to be applied in the same manner as the first-class rates under the Docket 13,535 adjustment. The Springfield, Mo., basis of rates is to apply from Galloway, Langston and Sequiota, Mo., to points to which specific or group first-class rates are published in the above-mentioned tariffs.—Docket No. 535.

Texas-Louisiana Tariff Bureau

Cement.—Carriers propose to amend Item 15 of Louisiana Lines' Tariff 6-A, to read as follows: "The rates published in this tariff will also apply on import (see Notes 1 and 2) and coastwise traffic (see Note 2)." "Note 1—Rates named herein applying on import traffic take precedence over all other rates." "Note 2—On import or coastwise traffic moving through Louisiana ports the rates named in this tariff do not include the cost of loading, unloading, handling or wharfage or other terminal charges at the ports, except that the rates will include switching charges only to the same extent as switching charges are absorbed on domestic traffic."—Docket No. 3,603-1-LA.

Transcontinental Freight Bureau

Pumice.—Shippers have requested the publication of a rate on volcanic ash and pumice from Shoshone, Calif. (T. & T. R. R.), to Cincinnati, O., of 68 c. in Tariff 3-G, subject to transit privileges as per individual lines tariffs.—Docket No. 15,970.

Consolidated Classification Committee

Gypsum.—Shippers propose the addition of pails as a shipping container in Item 18, p. 256 of Consolidated Freight Classification No. 8, along with cloth and paper bags, barrels and boxes, for powdered gypsum.—Docket No. 57, Sub. 119.

Poultry or Pigeon Grit.—Carriers propose to add to Item 10, p. 392 of Consolidated Freight Classification No. 8, covering poultry or pigeon grit, the following: "In cans or cartons in barrels or boxes, car-load minimum weight 36,000 lb., Official Class 30; Southern Class A or 8 and Western Class C." Also to change the ratings following the last two lines in this item to read, "In bulk in bags, barrels or boxes, or in bulk, car-load minimum weight 36,000 lb., Official Class 6, Southern Class 12 and Western Class E." This eliminates the Illinois Classification rating of Class E.—Docket No. 57, Sub. 54.

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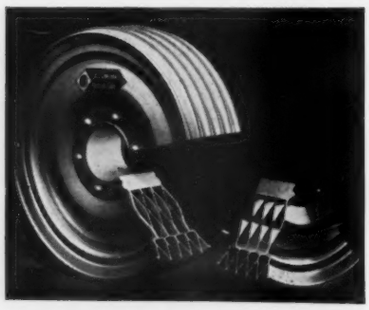
[1] The car-load minimum weight will be 90 per cent. of the marked capacity of the car, except that when the car is loaded to its full cubical or visible capacity, the actual weight will apply.

New Machinery and Supplies

Texsteel V-Belt Sheaves Are Now Available from ¼ to 15 Hp.

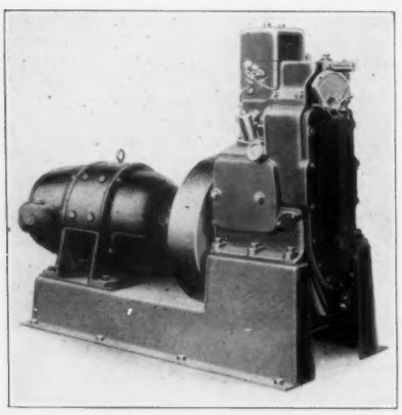
The Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces that Texrope V-belt drives with one or both sheaves Texsteel are now available from ¼ to 15 hp. Texsteel sheaves are grid-type construction with accurately-formed heavy-gage steel sections electrically welded at web and rim. Outer rims are rolled for protection, good appearance and strength. Integral bushings or solid-bored hubs are standard. The sheaves have an attractive aluminum finish.



Grid-type sheave for V-belt drive.

Make Light-Weight Four-Cycle Diesel Engines of 10 to 60 Hp.

Fairbanks, Morse & Co., Chicago, Ill., have developed a light-weight 4-cycle Diesel engine said to provide an adequate capacity-weight ratio. This engine is designed for both marine and mobile equipment as well as for stationary service and is available in sizes of 1, 2, 3, 4 and 6 cyl. with capacities of 10, 20, 30, 40 and 60 brake hp. The cylinder size is 4¼ in. by 6 in. and the normal operating speed, 1200 r.p.m.; the displacement is 85 cu. in. per cylinder and 5370 cu. in. per min. per hp. at rated speed. All the engines in the series are of the vertical type with airless injection of fuel.



Diesel-engine generating set.

The cylinders, in the multi-cylinder engines, are cast en-bloc with adequate reinforcing to obtain rigidity and permanent alignment of the chankshaft bearings and cylinder sleeves. The main bearings are embedded in a rigid lower base which is fitted with cover plates to facilitate service and inspection. Removable cylinder liners are employed in all sizes to insure minimum maintenance expense. Cylinder heads are thoroughly water jacketed with carefully-designed passages to insure even cooling and the combustion arrangements are for quiet operation and with clean exhaust over the entire load—and speed range. This construction, together with injection timing control is said to result in easy starting at low temperatures.

Lubrication is force feed throughout, with main bearings, connecting rod bearings, piston pin bearings, camshaft and timing gears as well as the entire clutch and reverse gear in marine engines, supplied with oil under pressure from the main system. The main bearings are large to give low bearing pressures. Intake and exhaust valves are made of a special alloy and are operated by push rods from the camshaft. The single camshaft which is totally enclosed in the engine crankcase is pressure lubricated, also carries the fuel injection cams, one for each cylinder. Cooling water is circulated by a reciprocating plunger-type pump driven from the camshaft at half engine speed. All pump connections are readily accessible from the outside.

Fuel pumps are of the individual mechanical injection type with fixed length of stroke and variable inlet cut off. They are mounted directly beside each cylinder with short, equal length connections to the nozzles. Nozzles are of the single orifice type and are easily removed for inspection.

Century splash-proof motor.

A flyball type governor of special design permits wide speed range with accurate control at all intermediate speeds.

The single cylinder engine can be readily started by hand cranking. On the 2 and 3-cyl. units hand cranking is the standard starting arrangement with 24-volt electric starting equipment offered as special equipment. The 4, 5 and 6-cyl. units are fitted with a complete electric starting system as standard equipment. For electric generating service, these engines are available equipped with either a.c. or d.c. generators in capacities of 6 to 40 kw.

Splash-Proof Electric Motor Line Ranges from 1 to 30 Hp.

The Century Electric Co., St. Louis, Mo., announces the completion of a line of splash-proof motors of from 1 to 30 hp. These motors have frame and end brackets of grey iron castings and one-way ventilation is provided by intake and outlet openings in the lower section of the end brackets. Cartridge-type, grease-lubricated ball bearings are used on these motors and the bearing brackets are fitted to the frames with long-contact sealed fit.

Automatic-Feed Wagon-Drill Will Drill in Any Direction

The Cleveland Rock Drill Co., Cleveland O., announces its new Model "WD" universal and automatic wagon drill which will drill holes in any direction and has automatic air feed. When feeding into the rock it is said that the mechanism automatically maintains the drilling machine at the right position for fastest cutting. When reversing or approaching the rock the speed of feeding may be varied from a few inches to 25 ft. or more per second. For ordinary rates of feed it is said that only 4 cu. ft. of air per minute are required for the feeding mechanism.

Wagon drill in vertical position.

The air feed cylinder serves as a boom or support for the guideways on which the slabback mounted machine travels when being fed into or reversed away from the

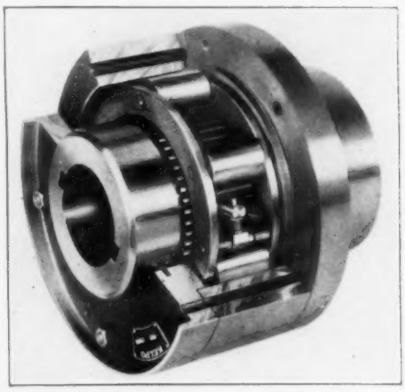
Automatic-feed wagon-drill in position for horizontal drilling.

rock. The boom is mounted on an offset "U-bar" which can be fixed in any position around the center line of the wheel axle. It is this arrangement which permits of drilling holes at an infinite variety of positions and angles.

The drilling machine is provided with a special blower. A slight pull on the blowing valve suddenly turns full pressure through a ¾-in. hole into the chuck chamber at the end of the shaft, automatically short stroking the hammer and blowing the hole. This hole blowing feature can be incorporated in a wet or dry drill.

Rubber Blocks Are Flexing Medium in Improved Coupling

The Morse Chain Co., Ithaca, N. Y., and Detroit, Mich., Division of Borg-Warner Corp., announce a new and improved flexible coupling, the Morflex, a companion to the Morse standard coupling, using specially-developed rubber as the flexing medium. The flexing member is a complete unit comprising four moulded non-cold-flow



Flexible coupling with rubber flexing medium.

rubber trunnion blocks of special design spaced 90 deg. apart and set, under pressure into a two-piece riveted steel housing. The rubber trunnion blocks are provided with steel cores or bushings also set under pressure into the blocks. The rubber is therefore always under pressure, which condition, it is known, prolongs its life qualities.

Two diametrically opposite blocks are bolted respectively to the armed steel driving and driven flanges which are mounted on the shafts to be connected. Thus all metal parts are rigid and all relative motion confined to the live non-cold-flow rubber. There is no metal contact between the flanges, the only contact between the two shafts is through the flexible rubber bushings or blocks. There is no movement between rubber and metal, all flexing being entirely within the rubber. It is said that shocks and uneven impulses are absorbed and sudden reversal can take place without damage. The Morflex Coupling needs no protection from atmospheric conditions, water, oil, dirt or grit, and requires no lubrication.

Patented Sand Hood Controls Hydraulic Dredge Efficiency

Captain Harvey L. Shotwell of Buffalo, N. Y., now deceased, has been granted a patent on the Alinwon sand hood, a new development in hydraulic dredging apparatus. This patent is now owned jointly by Capt. Shotwell's widow and H. B. Campbell, formerly Shotwell & Campbell, Buffalo, N. Y. This device is intended to increase the efficiency in any kind of hydraulic dredging. It is of simple construction, is said to be nearly snag-proof, and is equipped with a snag line to prevent the breaking of suction lines.

The hollow hinge or joint of the hood is made from pipe, the same kind or size used in the suction line and is electrically welded. The separator bail or

Sand hood for hydraulic dredges.

guard for the teeth is a steel forging and the teeth are of manganese steel. The hood is adjustable to the bottom and, it is said, can also be adjusted to blend sand and stone to the percentage of each desired. The construction of the hood is said to permit any desired amount of "fines" to drop or pass through without being subject to the suction of the pump, and to hold all solids.

New Hercules Motors Complete Line Ranging from 4 to 200 Hp.

The Hercules Motors Corp., Canton, O., has added two new small heavy duty engines and power units to its line, giving a complete range of sizes from 4 to 200 hp. These new 4-cyl. units are known as the "ZX" series and are identical in design. Their parts are inter-

Completely inclosed, gasoline power unit.

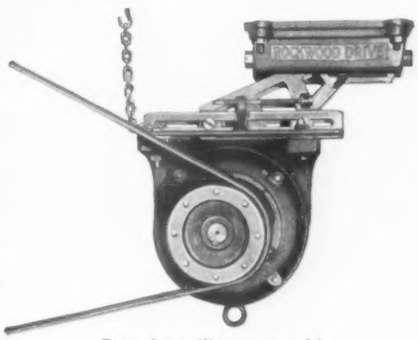
changeable, the only difference being in the bore sizes and parts affected thereby. The ZXA engine has a 2½-in. bore and 3-in. stroke and develops 22 hp. at 4,000 r.p.m.; the ZXB engine has a 2⅝-in. bore and develops 24½ hp. at this speed.

Special consideration has been given to valve cooling for sustained high-speed operation. Thermo-syphon cooling is standard but water pumps are available if specified. Either downdraft or up-draft manifolds are optional. Lubrication is of the full force-feed type to the main bearings and connecting rod bearings. The crankcase is cast integral with the block. The pistons normally are of cast iron and have three rings above the pin, the lower ring being of the oil regulating type. Aluminum pistons can also be supplied.

The ZX series engines are designed for application to commercial vehicles, industrial and road-building machinery, marine purposes and for general use. They are available in open and completely inclosed types and can be equipped to operate on kerosene and natural gas as well as gasoline. Different types of power takeoffs including stub shafts, clutch power takeoffs, and reduction gears are available.

Develop Ceiling and Vertical Electric-Motor Drive Bases

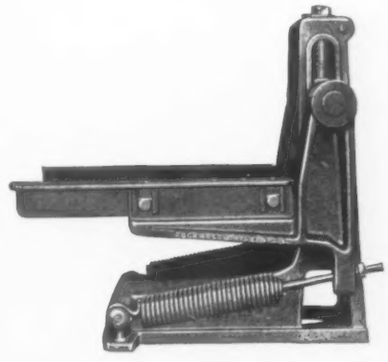
The Rockwood Mfg. Co., Indianapolis, Ind., has developed two new types of drive bases for electric motors for ceiling and vertical drives. The ceiling drive is similar to the standard base except that it has special hanger arms which suspend the motor horizontally



Base for ceiling motor drives.

and give greater clearance from the ceiling. The adjustable steel angles which move horizontally on the hanger arms are supported by a ledge cast on the bottom of the hanger arms. This ledge carries the weight of the motor and takes the weight from the slotted-head screws in the arm slot. This ledge also permits the screws to be loosened and the adjustable angles to be moved along the ledge, adjusting the belt tension, simply by turning the secondary arm screws while the drive is running.

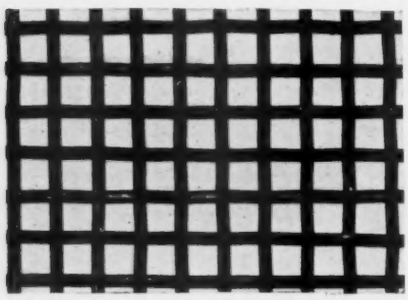
The Rockwood vertical drive base is said to eliminate the loss of tension due to belt stretch found in ordinary vertical drives. It differs from the standard horizontal drive base in that the force producing belt tension is derived from coiled springs instead of the weight of the motor. When the motor is located below the driven pulley the springs are adjusted to support only that portion of the motor's weight not needed to provide belt tension. When the motor is above the driven pulley the springs are adjusted to support the entire motor weight plus the necessary belt tension.



Vertical drive motor base.

National Announces Abrasion Resisting Spring-Steel Cloth

The National Wire Cloth Co., St. Paul, Minn., announces its spring-steel wire cloth for use in crushed-stone, sand-and-gravel, cement, lime and other non-metallic plants. This cloth is made in sizes ranging from 1/16-in. to 6-in.



National spring-steel wire cloth.

openings, the spring rods used ranging up to 1 in. in diameter where coarse screening is to be done. This cloth is said to be long wearing and to have a high resistance to abrasion.

Aggregates (from Page 44)

was less than those of sand and gravel. However, preliminary returns from producers who accounted for 36 per cent. of the 1932 output indicate a drop of 18 per cent. in 1933. The commercial production of crushed stone in 1933 probably amounted to about 36,000,000 short tons. If noncommercial production continued at about the same rate as in the previous year, the total for 1933 may have been about 45,000,000 short tons, compared with a total of 51,995,100 short tons in 1932.

Unlike sand and gravel, crushed-stone prices did not show any tendency toward stiffening in 1933. Sample returns reveal that prices, f.o.b. plant, in 1933 were about 10 per cent. lower than in 1932.

Falk Corp. Licenses J. D. Christian to Make Motors

It is announced that the Falk Corp., Milwaukee, Wis., has licensed J. D. Christian Engineers, also of Milwaukee, for the manufacture of Rite-Lo-Speed motors under the original Christian design. The Falk Corp. now owns this patent which was originally issued to J. D. Christian.

Chain Belt Co. Appoints New Idaho Distributor

The Chain Belt Co., Milwaukee, Wis., announces the appointment of the Intermountain Equipment Co., Boise, Idaho, as its distributor for the Rex line of equipment in the Boise territory.

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces the removal of its Buffalo District office to the Library Bank Bldg., Buffalo, N. Y.

Manufacturers' Publications

Copies of any of the publications mentioned in this magazine may be had by writing the manufacturers who publish them. Please mention PIT & QUARRY *when writing.*

Crushing and Grinding

Jaw Crushers. 20 p. (Bull. No. 265A. Smith Engineering Works, Milwaukee, Wis.) Describes and illustrates the Telsmith-Wheeling jaw crushers and the Telsmith portable plants in which these crushers are used.

Crushing Plant Machinery. 28 p. (Bull. No. 1473. Allis-Chalmers Mfg. Co., Milwaukee, Wis.) Describes and illustrates the various crushers, pulverizers, screens, washers and other crushing plant machinery made by this company.

Patterson Grinding Mills. 4 p. (Bulletin. Patterson Foundry & Machine Co., East Liverpool, O.) Illustrates installations of these mills in various industries.

Cedar Rapids Portable Plants. 8 p. (Bull. Iowa Mfg. Co., Cedar Rapids, Ia.) Describes and illustrates the various types of straight-line all-purpose plants made by this company.

Road-Building Equipment. (Circular, Gruendler Crusher & Pulverizer Co., St. Louis, Mo.). Describes and illustrates the various types of equipment offered by this company, including jaw, eccentric, and roller crushers, shaker and rotary screens, bucket elevators, portable straight-line and combination crushing and screening plants, and semi-portable and stationary plants.

Raymond Review, 1933. 16 p. (Bulletin. Raymond Bros. Impact Pulverizer Co., Chicago, Ill.) Describes briefly and illustrates some of the important and unusual operations performed by Raymond mills, pulverizers and air separators.

Pumping

Centrifugal Pumps. 4 p. (Worthington Pump & Machinery Corp., Harrison, N. J.) Bulletin describes and illustrates the Worthington Type UB two-stage volute centrifugal pumps.

Double-Suction Pumps. 8 p. (Bull. No. 150. Morris Machine Works, Baldwinsville, N. Y.) Describes and illustrates the Morris double-suction high-speed pumps and their specifications.

Miscellaneous

Austin-Western Catalog. 24 p. (Catalog No. 1320. Austin-Western Road Machinery Co., Chicago, Ill.) 1934 general reference catalog describes the various types of shovels, dump wagons, portable plants and other equipment made by this company.

Electric Vibrating Conveyors. 4 p. (Bull. No. 581. Jeffrey Mfg. Co., Jeffrey-Traylor Div., Columbus, O.) Describes and illustrates the Jeffrey-Traylor electric vibrating conveyors and their applications in different fields.

Gravity Storage Bins. (Neff & Fry Co., Camden, O.) Folder describes and illustrates various installations of Neff & Fry Super-Concrete stave gravity-storage bins.

Detachable Bits. (Ingersoll-Rand Co., Phillipsburg, N. J.) Bulletin lists the complete line of all types and sizes of "Jackbits" made by this company.

Repulsion-Start Induction Motors. (Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.) Illustrated leaflet describes the Type CR single-phase repulsion-start induction motors made by this company in sizes of from ¾ to 3 hp.

Electric Vibrating Feeders. 8 p. (Bull. No. 582. Jeffrey Mfg. Co., Jeffrey-Traylor Div., Columbus, O.) Describes and illustrates various types and sizes of Jeffrey-Traylor vibrating feeders and their applications to various industries.

Electric Car Pullers. 16 p. (Bull. J-6. Clyde Iron Works, Duluth, Minn.) Describes in detail the various types and sizes of electric car pullers made by this company and illustrates a number of typical installations.

Electric Hoists. 52 p. (Catalog No. 35. Ottumwa Iron Works, Ottumwa, Ia.) Describes and illustrates various types and sizes of electric hoists. A number of hoisting engine data sheets are included.

Hard-Facing with Haynes Stellite. 96 p. (Haynes Stellite Co., Kokomo, Ind.) Describes and illustrates the various applications of this product in different industries and gives savings made. Various hard-surfacing products described.

Insulation. (Johns-Manville, New York, N. Y.) Describes specifications, methods and materials for insulating rotary cement and lime kilns, power plant equipment, pipes, etc.

Leaded Bearing Metal. (Burlington Metal Corp., Milwaukee, Wis.) Pamphlet describes the BMC leaded bearing metal, its qualities and the various uses to which it can be applied.

Burlington Metal Appoints Mining & Hydraulic Equip.

The Mining & Hydraulic Equipment Co., 211 W. Wacker Drive, Chicago, Ill., has been appointed by the Burlington Metal Corp., Milwaukee, Wis., as its representative in Iowa, Illinois, and part of Indiana. This company also represents the Knickerbocker Co., Jackson, Mich., the Atlas Imperial Diesel Engine Co., Oakland, Cal., and the Fred T. Kern Co., Milwaukee, Wis., in the Chicago territory.

The Poole Foundry & Machine Co., Baltimore, Md., announces the appointment of the J-B Engineering Sales Co., New Haven, Conn., as their representative in the state of Connecticut.

New Corporations

AUGLAIZE SAND & GRAVEL CO., Lima, O. Capital $25,000; 500 shares n.p.v. Ruth Endly, Elmer E. Welty, Chester A. Churchill; Melvin G. Light, 1106 National City Bldg.

COLONIAL CONCRETE CO., West Orange, N. J. Harry J. Axt, pres.; Adolph R. Frank, tr.

DIATOMITE CORP., Paterson, N. J. 2,500 shares n.p.v. Sam Mendelsohn, agent.

GRANITE QUARRIES, INC., Yonkers, N. Y. 100 shares common n.p.v. Directors are Peter J. Smykla, 190 Palisade Ave., Eva W. Hudak, 14 Brewster Ave., and Catherine A. Panzer, 45 Chase Ave.

INDEPENDENT POTASH & CHEMICAL CO., Phoenix, Ariz. C. Martin Stoddard and F. Horton.

LIMESTONE PRODUCTS, INC., Salem, Ore. Capital $12,500. Walter Fuhrer, Cuyler Van Patten and E. V. McMechan.

THE NORTHERN GRANITE CO., INC., Barron, Wis. 200 shares @ $100. A. B. Wells, F. J. Wells and Z. Jones.

OZARK MINERALS CO., Cairo, Ill. 250 shares common. J. W. Peterson, J. E. Clutts and A. M. Davis.

THE PORTABLE GRAVEL CO., INC., Lansing, Mich. Capital $25,000; $6,000 paid.

POTOMAC GLASS SAND CO., 85 Fifteenth St., Wheeling, W. Va. Plant to be in Macon County, near Village of Cacapon, W. Va. Charles F. Paul, Jr., C. Lee Spillers and Florence M. Rauch.

SOLVANG DEVELOPMENT CO., Solvang, Cal. H. C. Johnson, pres.; Paul Lassen, Los Angeles, Cal., v.-pres.; Jay Dutter, Los Angeles, Cal., sec.-tr.

SUPERIOR LIME CO., 354 Scholes St., Brooklyn, N. Y. Sylvan Solomon.

WESTERN PORTLAND CEMENT CO. (Utah), Ogden, Utah. 2,000 shares n.p.v.; $10 paid for each share.

strength

GOODYEAR K-RIMS *make tire changing easy—give added strength and safety —save time and money.*

For Extreme Service

—That's the kind of service demanded of truck tires that haul cement, crushed stone, gypsum, lime, sand and gravel.

Goodyears have that *extra* STRENGTH for heavy loads. That tough ground-gripping All-Weather tread for better TRACTION—more POWER. And under the tread—patented pre-shrunk Supertwist Cord construction for long life—ECONOMY. *It's no wonder more tons are hauled on Goodyear Truck Tires than on any other kind.*

These exclusive Goodyear features are your assurance of the best—and Goodyears cost no more than ordinary tires.

- **Patented pre-shrunk Supertwist cord construction.**
- **Body rubber chemically toughened.**
- **New flat, high-shoulder tread shape.**
- **New improved bead construction.**
- **World-famous, exclusive All-Weather tread.**
- **Pima cotton, longest fibre grown.**

Ask the nearest Goodyear dealer to prove to you by actual test that Goodyear Truck Tires are MONEY SAVERS.

NRA
WE DO OUR PART

GOODYEAR

TRUCK TIRES — *Money savers*

Classified Buyers' Guide

A Directory of Pit and Quarry Advertisers Arranged According to Product

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.

Index to Advertisers on Page 64

Agitating Ladders (Dredge)
*Eagle Iron Works
Pettibone Mulliken Co.

Aftercoolers (Air)
Worthington Pump & Mchy. Corp.

Air Compressors (Portable)
Worthington Pump & Mchy. Corp.

Air Compressors (Stationary)
Worthington Pump & Mchy. Corp.

Air Separators
*Gruendler Crusher & Pulv. Co.
Raymond Bros. Impact Pulv. Co.

Alloys, Steel
Chicago Steel Foundry Co.

Ash and Refuse-Handling Equipment
Allen-Sherman-Hoff Co.
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Hetherington & Berner, Inc.
*Link-Belt Co.
*Robins Conveying Belt Co.

Automatic Feeders
*Bartlett & Snow Co., C. O.
*Link-Belt Co.

Automatic Weighers
*Bartlett & Snow Co., C. O.

Balls (Grinding)
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.

Balls (Tube-Mill, etc.)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.

Bearings (Anti-Friction)
*Bartlett & Snow Co., C. O.
*Hetherington & Berner, Inc.
*Link-Belt Co.
*Robins Conveying Belt Co.

Belting
Goodyear Tire & Rubber Co.
Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Robins Conveying Belt Co.
Self-Vulcanizing Rubber Co.
Thermoid Rubber Co.

Belting (Multiple V)
Goodyear Tire & Rubber Co.
Thermoid Rubber Co.

Bin Gates
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Bins (Cast Iron)
Allen-Sherman-Hoff Co.

Bins (Steel)
*Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.
*Hetherington & Berner, Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.

Blast-Hole Drills (See Drills—Blast-Hole)

Blasting Machines
Atlas Powder Co.
*Hercules Powder Co.

Blasting Supplies
Atlas Powder Co.
*Ensign-Bickford Co.
*Hercules Powder Co.

Blocks (Sheave)
*Sauerman Bros., Inc.

Blowers
Worthington Pump & Mchy. Corp.

Bodies (Motor Truck, Concrete Mixing)
*Bartlett & Snow Co., C. O.

Borings, Core
Mott Core Drilling Co.
Pennsylvania Drilling Co.

Brake Linings
Thermoid Rubber Co.

Breakers (Concrete, Air)
Worthington Pump & Mchy. Corp.

Bronze Work (Ornamental)
National Wire Cloth Co.

Bucket Elevators (See Conveyors and Elevators)

Buckets (Clamshell, Orange-Peel, Etc.)
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Link-Belt Co.
Pettibone Mulliken Co.
Wellman Engr. Co.

Buckets (Dragline—Cableway)
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
*Sauerman Bros., Inc.
Wellman Engr. Co.

Buckets (Elevator and Conveyor)
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Pettibone Mulliken Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Cableways
*American Steel & Wire Co.
*Link-Belt Co.
*Sauerman Bros., Inc.

Caps (Blasting)
Atlas Powder Co.
*Hercules Powder Co.

Capstans (See Winches and Capstans)

Car Dumpers
*Link-Belt Co.
Wellman Engr. Co.

Car Pullers
*Bartlett & Snow Co., C. O.
*Link-Belt Co.

Carriers
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Car Wheels — (See Wheels — Car)

Castings
*Bartlett & Snow Co., C. O.
*Eagle Iron Works
*Hetherington & Berner, Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.
*Link-Belt Co.
McLanahan and Stone Corp.
Pettibone Mulliken Co.
*Robins Conveying Belt Co.

Cement Pumps (See Pumps; Air Pumps; Pumps, Cement Slurry; Pumps, Bulk Cement)

Central Concrete-Mixing Plants (Complete)
*Bartlett & Snow Co., C. O.

Chain Drives
*Link-Belt Co.

Chain (Elevating and Conveying)
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Link-Belt Co.

Chutes and Chute Liners
*Bartlett & Snow Co., C. O.
Goodyear Tire & Rubber Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
*Robins Conveying Belt Co.

Classifiers
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
*Link-Belt Co.

Clips (Wire Rope)
*American Steel & Wire Co.

Clutches
*Link-Belt Co.

Coal-Pulverizing Equipment
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Raymond Bros. Impact Pulv. Co.

Compressors (See Air Compressors)

Cones (Sand-Washing)
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
Smith Engr. Works

Conveyor Belting (See Belting)

Conveyors Idlers and Rolls
Barber-Greene Co.
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
*Robins Conveying Belt Co.

Conveyors and Elevators
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Barber-Greene Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulv. Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Universal Crusher Co.

Conveyors (Ready-Mixed Concrete)
*Bartlett & Snow. Co., C. O.
*Robins Conveying Belt Co.

Coolers (See Kilns and Coolers —Rotary)

Couplings (Flexible and Shaft)
*Link-Belt Co.
*Robins Conveying Belt Co.

Couplings (Hose, Pipe, etc.)
Thermoid Rubber Co.

Cranes (Crawler and Locomotive)
*Link-Belt Co.
Ohio Power Shovel Co.

Crusher Parts
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.
McLanahan and Stone Corp.
Pettibone Mulliken Co.

Crushers (Hammer)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Dixie Machy. Mfg. Co.
*Gruendler Crusher & Pulv. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Universal Crusher Co.

Crushers (Jaw and Gyratory)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulv. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.
Lewistown Foundry & Machinery Co.
Smith Engr. Works
Universal Crusher Co.

Crushers (Ring)
*Bartlett & Snow Co., C. O.

Crushers (Roll)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulv. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.

Crushers (Rotary)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.

Crushing Rolls
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.

Detonators
Atlas Powder Co.
*Hercules Powder Co.

Diesel Engines (See Engines—Diesel)

Dipper Teeth
Pettibone Mulliken Co.

Dragline Cableway Excavators
*Link-Belt Co.
*Sauerman Bros., Inc.

Dragline Excavators
*Link-Belt Co.
Ohio Power Shovel Co.
*Sauerman Bros., Inc.

*** See also information in the 1933 Pit and Quarry HANDBOOK.**

Haiss Leadership Again Asserts Itself!

New Model 135

5 yards per min.

Oil Engine power

Down come the costs of truck loading! The new Haiss 135 costs just about $1,000 more than a 2 yd.-a-minute loader—and has 3 yds. a minute greater capacity. That's a lot of work, and "a lot of machine" for very little money.

You know the Haiss reputation for high quality. The Model 135 carries on as the big brother of the 3-yd. "80", the 2-yd. "27" and the 1½-1¾-yd. Model 50.

Catalog 134 on request

George Haiss Manufacturing Co., Inc.

142d St. & Rider Ave. New York

Photographed putting up a 17,400 lb. load of 2" crushed stone in 63 seconds. No "truck waiting time" lost there!

PIT AND QUARRY

Research Department

538 South Clark St., Chicago, Ill.

Please send me catalogs and prices concerning the following items checked below:

- ☐Agitators, sand and Gravel
- ☐Agitators, Slurry
- ☐Air cleaners
- ☐Air compressors
- ☐Bag filling and weighing machinery
- ☐Bags, cloth
- ☐Bags, paper
- ☐Balls, steel
- ☐Barges, steel
- ☐Belt dressing
- ☐Belt fasteners
- ☐Belting, conveyor and elevator
- ☐Belting, transmission
- ☐Belt lacing
- ☐Belt plates
- ☐Belt rivets
- ☐Belt tighteners
- ☐Bin gates
- ☐Bins, concrete
- ☐Bins, steel
- ☐Blasting supplies
- ☐Blasting powder
- ☐Blocks, friction
- ☐Boats, self-unloading
- ☐Bodies, Motor Trucks
- ☐Brake Linings
- ☐Buckets, Clamshell
- ☐Buckets, Conveyor and Elevator
- ☐Buckets, Dragline
- ☐Buckets, Orange Peel
- ☐Cableways, Slackline
- ☐Calcining Machinery
- ☐Car Dumpers
- ☐Car Pullers and Movers
- ☐Carriers, Belt
- ☐Cars, Dump
- ☐Cars, Kiln
- ☐Castings, Manganese Steel
- ☐Castings, Steel
- ☐Chains, Conveyor and Elevator
- ☐Chains, Power Shovel, Crane and Dredge
- ☐Chains, Transmission
- ☐Chutes
- ☐Classifiers
- ☐Clips, Wire Rope
- ☐Clutches
- ☐Clutches, Magnetic
- ☐Concrete Plants, Ready Mixed
- ☐Cones, Washing
- ☐Conveyors, Apron
- ☐Conveyors, Belt
- ☐Conveyors, Pneumatic
- ☐Conveyors, Screw
- ☐Conveyors, Skip
- ☐Coolers
- ☐Couplings, Flexible
- ☐Couplings, Hose
- ☐Cranes, Locomotive
- ☐Cranes, Overhead Traveling
- ☐Cranes, Truck
- ☐Crushers, Cone
- ☐Crushers, Disc
- ☐Crushers, Gyratory
- ☐Crushers, Hammer
- ☐Crushers, Jaw
- ☐Crushers, Ring
- ☐Crushers, Roll
- ☐Crushers, Rotary
- ☐Cutter Heads, Dredging
- ☐Derricks
- ☐Draglines, Cableway
- ☐Draglines, Revolving Boom
- ☐Dredges, Dipper
- ☐Dredges, Hydraulic
- ☐Dredges, Ladder
- ☐Drill Sharpening Machinery
- ☐Drills, blast hole
- ☐Drills, Diamond Core
- ☐Drills, Hand Hammer
- ☐Dryers, Rotary
- ☐Dryers, Sand and Gravel
- ☐Dust Collecting Systems
- ☐Dynamite
- ☐Elevators, Bucket
- ☐Engines, Diesel
- ☐Engines, Gas
- ☐Engines, Gasoline
- ☐Engines, Hoisting
- ☐Engines, Oil
- ☐Feeders
- ☐Filters, Air
- ☐Filters, Oil
- ☐Fire Brick
- ☐Flanges, Pipe
- ☐Frogs and Switches
- ☐Fuses, Blasting
- ☐Gears
- ☐Goggles
- ☐Governors
- ☐Grinding Balls
- ☐Grizzlies
- ☐Guns, Hydraulic
- ☐Hoists, Air
- ☐Hoists, Derrick
- ☐Hoists, Drum
- ☐Hoists, Motor Truck Body
- ☐Hoists, Skip
- ☐Hose, Air Steam, Water
- ☐Hose, Sand Suction
- ☐Hydrators
- ☐Kettles, Calcining
- ☐Kilns, Rotary
- ☐Kilns, Vertical
- ☐Linings, Kiln
- ☐Loaders, Portable
- ☐Loaders and Unloaders, Box Car
- ☐Locomotives, Diesel
- ☐Locomotives, Gasoline
- ☐Locomotives, Steam
- ☐Log Washers
- ☐Measuring Devices
- ☐Mills, Compartment
- ☐Mills, Tube
- ☐Mixers, Plaster
- ☐Motors, Electric
- ☐Motors, Gasoline
- ☐Motor Trucks
- ☐Motor Trucks, Ready Mixed Concrete
- ☐Nozzles, Hydraulic Mining
- ☐Nozzles, Gravel Washing
- ☐Nozzles, Spray
- ☐Nozzles, Dust Settling
- ☐Nozzles, Suction Hose
- ☐Nuggets, Grinding Perforated Metal
- ☐Poidometers
- ☐Pulleys, Clutch
- ☐Pulleys, Magnetic
- ☐Pulverized Fuel Systems
- ☐Pulverizers, Ball, Conical, Pebble
- ☐Pulverizers, Disc
- ☐Pulverizers, Hammer
- ☐Pulverizers, Ring
- ☐Pulverizers, Rod
- ☐Pulverizers, Roll
- ☐Pumps, Centrifugal
- ☐Pumps, Deep Well
- ☐Pumps, Sand and Gravel
- ☐Pumps, Slurry
- ☐Pumps, Steam
- ☐Radiators, Engine Cooling
- ☐Rails
- ☐Refractories
- ☐Respirators
- ☐Rollers, Conveyor
- ☐Rolls, Crushing
- ☐Rope, Wire
- ☐Safety Appliances
- ☐Sand-Lime-Brick Machinery
- ☐Scales, Track
- ☐Scales, Truck
- ☐Scrapers, Dragline
- ☐Screens, Revolving
- ☐Screens, Shaking
- ☐Screens, Vibrating
- ☐Separators, Air
- ☐Separators, Dry Centrifugal
- ☐Separators, Magnetic
- ☐Shovels, Gasoline
- ☐Shovels, Steam
- ☐Skips
- ☐Sleeves, Dredge
- ☐Slugs and Nuggets, Grinding
- ☐Speed Reducers and Gears
- ☐Spray Nozzles
- ☐Sprays, Paint
- ☐Sprockets
- ☐Steel, Tool
- ☐Stokers
- ☐Switches, Track
- ☐Tanks, Concrete and Steel
- ☐Tanks, Sand Settling
- ☐Tanks, Wood
- ☐Thickeners, Slurry
- ☐Track, Portable
- ☐Track Shifters
- ☐Tractors, Crawler
- ☐Tramways, Aerial
- ☐Trippers, Belt
- ☐Trippers, Tramway
- ☐Unloaders
- ☐Valves, Pump
- ☐Washers and Scrubbers, Sand, Gravel, Stone
- ☐Weighters, Automatic
- ☐Welding Supplies
- ☐Wheels, Car
- ☐Winches
- ☐Wire Cloth
- ☐Wire Cloth, Manganese Steel

To be used for.....

Firm Name..... *Individual*.....

Address..... *City*..... *State*.....

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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Dredges
*Hetherington & Berner, Inc.
*Morris Machine Works

Drilling Accessories
Worthington Pump & Mchy. Corp.

Drilling Contractors
Mott Core Drilling Co.
Pennsylvania Drilling Co.

Drills (Blast Hole)
Worthington Pump & Mchy. Corp.

Drills, Diamond
Mott Core Drilling Co.
Pennsylvania Drilling Co.

Drills (Rock)
Worthington Pump & Mchy. Corp.

Drills (Well) (See Drills—Blast-Hole)

Drives (Multiple, Belt, Chain, Rope)
*Allis-Chalmers Mfg. Co.
Worthington Pump & Mchy. Corp.

Dryers
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.
Lewistown Fdry. & Mch. Co.
McLanahan and Stone Corp.

Dust-Collecting Systems
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Raymond Bros. Impact Pulv. Co.

Dust Handling Systems (Hydro Vacuum)
Allen-Sherman-Hoff Co.

Dynamite (See Explosives)

Electrical Equipment
*Allis-Chalmers Mfg. Co.

Elevator Belting (See Belting)

Elevators (See Conveyors and Elevators)

Engineers
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Hetherington & Berner, Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Wellman Engr. Co.

Engines (Diesel)
Worthington Pump & Mchy. Corp.

Engines (Internal-Combustion)
Worthington Pump & Mchy. Corp.

Engines (Steam)
*Morris Machine Works

Excavating Machinery (See Shovels; Cranes; Buckets; etc.)

Excavators—Shallow Grading (Bucket Elevator Type)
Haiss Mfg. Co., Geo.

Explosives
Atlas Powder Co.
*Hercules Powder Co.

Fans (Exhaust)
*Kennedy-Van Saun Mfg. and Eng. Corp.

Feeders
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Morrow Mfg. Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Feed Water Heaters
Worthington Pump & Mchy. Corp.

Floor Sweeping Systems (Hydro Vacuum)
Allen-Sherman-Hoff Co.

Fuses (Detonating)
Atlas Powder Co.
*Ensign-Bickford Co.
*Hercules Powder Co.

Gaskets
Goodyear Tire & Rubber Co.
Thermoid Rubber Co.

Gasoline Engines (See Engines—Internal-Combustion)

Gas Producers
Wellman Engr. Co.

Gates (Bin) (See Bin Gates)

Gates (Clamshell)
Haiss Mfg. Co., Geo.

Gears (Herringbone)
*Bartlett & Snow Co., C. O.
*Link-Belt Co.

Gears and Pinions
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Link-Belt Co.
Pettibone Mulliken Co.

Gelatin (See Explosives)

Generators (See Motors and Generators)

Glass Sand Equipment
Lewistown Foundry & Machine Co.

Grab Buckets (See Buckets—Clamshell, Orange - Peel, etc.)

Grating (Steel)
*Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.

Grinding Balls (See Balls, Grinding)

Grizzlies
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Eagle Iron Works
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdy. & Mach. Co.
Pettibone Mulliken Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Guards (Wire)
*Bartlett & Snow Co., C. O.
National Wire Cloth Co.

Guns (Hydraulic)
Georgia Iron Works
*Hetherington & Berner, Inc.

Hammer Mills (See Crushers—Hammer)

Hoists
*Bartlett & Snow Co., C. O.
*Hetherington & Berner, Inc.
*Link-Belt Co.
McLanahan and Stone Corp.
Pioneer Gravel Equipment Mfg. Co.
*Sauerman Bros., Inc.
Smith Engr. Works

Hoppers
*Hendrick Mfg. Co.

Hose (Air, Steam and Water)
Goodyear Tire & Rubber Co.
Self-Vulcanizing Rubber Co.
Thermoid Rubber Co.
Worthington Pump & Mchy. Corp.

Hose Couplings (See Couplings)

Hydraulic Guns (See Guns—Hydraulic)

Idlers
Barber-Greene Co.
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Kilns and Coolers (Rotary)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.

Lime-Handling Equipment
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
Raymond Bros. Impact Pulv. Co.
*Robins Conveying Belt Co.

Lime Kilns
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.

Linings (Ball- and Tube-Mill) (See Mill Liners and Linings)

Liquid Rubber
Self-Vulcanizing Rubber Co.

Loaders and Unloaders
Barber-Greene Co.
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Robins Conveying Belt Co.

Locomotives (Electric, Gas and Steam)
*Lima Locomotive Works

Magnetic Pulleys (See Pulleys, Magnetic)

Manganese Steel
Pettibone Mulliken Co.

Manganese Steel (Plates and Sheets)
Pettibone Mulliken Co.

Mill Liners and Linings
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.

Mills (Grinding) (See also Crushers—Hammer)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulv. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.
Lewistown Fdy. & Mch. Co.
Raymond Bros. Impact Pulv. Co.

Motor Trucks
General Motors Truck Co.

Motors and Generators
*Allis-Chalmers Mfg. Co.

Motors (Internal-Combustion) (See Engines — Internal-Combustion)

Nails
*American Steel & Wire Co.

Nozzles (Hydraulic) (See Guns—Hydraulic)

Packings
Goodyear Tire and Rubber Co.
Self-Vulcanizing Rubber Co.

Pawls
Stephens-Adamson Mfg. Co.

Perforated Metal Plates
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
*Hendrick Mfg. Co.
Morrow Mfg. Co.

Pipe Flanges
Georgia Iron Works
*Hetherington & Berner, Inc.

Plastic Rubber
Self-Vulcanizing Rubber Co.

Plug Valves (See Valves)

Pneumatic Drills (See Drills, Rock)

Portable Conveyors
Barber-Greene Co.
Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Robins Conveying Belt Co.

Portable Crushing and Screening Plants
Barber-Greene Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulv. Co.
Universal Crusher Co.

Portable Engines (See Engines—Internal Combustion)

Portable Loaders (See Loaders and Unloaders)

Power Cables (Rubber Clad)
*American Steel & Wire Co.

Power Shovels (See Shovels, Electric, Internal-Combustion and Steam)

Pulverized Fuel Systems
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Raymond Bros. Impact Pulv. Co.

Pulverizers (See also Crushers; Mills; etc.)
*Bartlett & Snow Co., C. O.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Krupp Grusonwerk, Fried.
Lewistown Foundry & Machinery Co.
Raymond Bros. Impact Pulv. Co.
Universal Crusher Co.

Pump Valves (See Valves Pump)

Pumps (Cement Slurry)
Allen-Sherman-Hoff Co.
*Morris Machine Works

Pumps (Centrifugal)
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Georgia Iron Works
*Hetherington & Berner, Inc.
*Morris Machine Works
Pettibone Mulliken Co.
Worthington Pump & Mchy. Corp.

Pumps (Dredging)
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Georgia Iron Works
*Hetherington & Berner, Inc.
*Morris Machine Works
Pettibone Mulliken Co.
Worthington Pump & Mchy. Corp.

Pumps (Sand and Gravel)
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Georgia Iron Works
*Hetherington & Berner, Inc.
*Morris Machine Works
Pettibone Mulliken Co.

*** See also information in the 1933 Pit and Quarry HANDBOOK.**

AUTOBIOGRAPHY of an EXPLOSION

The Bichel Gauge is a remarkable laboratory apparatus that records the amount of pressure generated at every instant during the split-second duration of an explosion. Its chart may be likened to a slow-motion picture . . . in effect, slowing up an explosion so its characteristics can be observed.

Study of these data aids us:

1. To develop explosives to meet various field conditions.

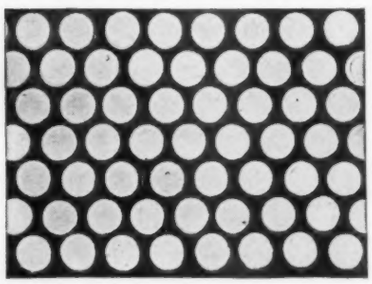
2. To help make certain that our explosives adhere to specifications.

Hercules owns one of the few Bichel Gauges in this country. By means of this and other exacting tests we obtain the reliability so characteristic of Hercules explosives.

HERCULES POWDER COMPANY
INCORPORATED
960 King Street, Wilmington, Delaware

A-39R

MORROW SCREEN PLATES

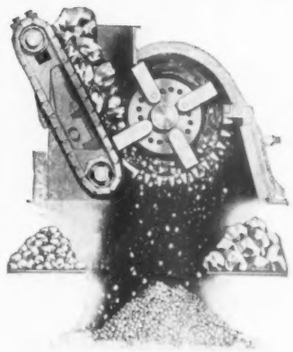


MORROW PERFORATED METAL SCREEN PLATES for sizing and preparing coal, sand, gravel, stone and other bulk materials are made by a Company specializing in screening machinery.

A complete set of punches and dies covering a wide range of sizes, in round, square, oval and diagonal slots are ready for the press, insuring prompt delivery of orders.

Prices are right.
Send for Bulletin 57.

The Morrow Manufacturing Co.
Wellston, Ohio



The DIXIE in action

IF it's a DIXIE "you're in the money"

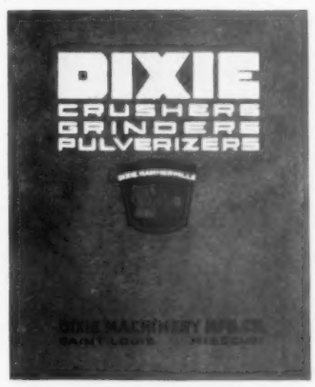
—and you've got what it takes to get along in the hardest kind of crushing work.

That is where your profits come in *and keep coming in*—no uncertainties, no interruptions, no breakdowns to burden you with needless losses—just steady going, day after day, on the toughest jobs.

The extra sturdy construction of the DIXIE MOGUL Non-Clog Hammermill is in itself a guarantee of low operating costs and minimum maintenance. Note this fact: that the special moving breaker plate has 26 times the average wearing area. This is one of the many reasons why the Dixie outcrushes and outlasts the average machine on the job.

Whether you are on government work or private projects, you need the advantage that the cost-saving features of Dixie Crushers can give you. Send for new catalog today, and get the facts about DIXIE MOGUL Non-Clog Hammermills—it pays to be "Dixie-wise" in buying crushing equipment.

DIXIE
MACHINERY MFG. CO.
4310 GOODFELLOW AVE., ST. LOUIS



Write for your copy TODAY. 32 Pages of facts on modern crushing methods.

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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Ready-Mixed Concrete Plants
*Bartlett & Snow Co., C. O.

Rock Drills (See Drills—Rock)

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*Kennedy-Van Saun Mfg. and Eng. Corp.

Rope (Wire) (See Wire Rope)

Rust Protection
Self-Vulcanizing Rubber Co.

Sand Separators
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
McLanahan and Stone Corp.
Smith Engr. Works

Sand-Settling Tanks
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
Smith Engr. Works

Scrapers (Power Drag)
*Link-Belt Co.
*Sauerman Bros., Inc.

Screens
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
Deister Machine Co.
*Eagle Iron Works
*Gruendler Crusher & Pulv. Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
National Wire Cloth Co.
Productive Equip. Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
Universal Crusher Co.

Screens (Vibrating or Shaking)
*Allis-Chalmers Mfg. Co.
Barber-Greene Co.
*Bartlett & Snow Co., C. O.
Deister Machine Co.
*Gruendler Crusher & Pulv. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Productive Equip. Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
Universal Crusher Co.

Separators (Air) (See Air Separators)

Sheaves
*Allis-Chalmers Mfg. Co.
*Eagle Iron Works
*Gruendler Crusher & Pulv. Co.
Haiss Mfg. Co., Geo.
*Hetherington & Berner, Inc.
*Link-Belt Co.
McLanahan and Stone Corp.
Pettibone Mulliken Co.

Shovels (Electric, Internal Combustion and Steam)
*Link-Belt Co.
Ohio Power Shovel Co.

Skip Hoists and Skips
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Hetherington & Berner, Inc.
*Link-Belt Co.
*Robins Conveying Belt Co.

Speed Reduction Units
*Link-Belt Co.

Spouts (See Chutes and Chute Liners)

Sprockets and Chain
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
Pettibone Mulliken Co.

Steel Grating (See Grating, Steel)

Steel Inclines (See Inclines, Steel)

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*Hendrick Mfg. Co.
*Hetherington & Berner, Inc.

Storage Equipment
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Sauerman Bros., Inc.

Sweeping Systems
Allen-Sherman-Hoff Co.

Tanks
*Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.

Tanks (Sand-Settling)
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
Morrow Mfg. Co.
Smith Engr. Works

Tires (Truck)
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Track Equipment
Pettibone Mulliken Co.

Tools (Drill) (See Drilling Accessories)

Tractors
*Allis-Chalmers Mfg. Co.

Trailers
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Tramways (Aerial)
*American Steel & Wire Co.

Transformers
*Allis-Chalmers Mfg. Co.

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Transmission Machinery
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulv. Co.
*Link-Belt Co.

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*Link-Belt Co.
*Robins Conveying Belt Co.

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*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.

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*Bartlett & Snow Co., C. O.
*Link-Belt Co.

Valves (Air)
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Variable Speed Reducers or Transmissions
*Link-Belt Co.

Vibrating Screen Plate
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
*Hendrick Mfg. Co.
Morrow Mfg. Co.

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Washers (Sand, Gravel and Stone)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Eagle Iron Works
Haiss Mfg. Co., Geo.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Smith Engr. Works

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*American Steel & Wire Co.
Manganese Steel Forge Co.

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*Eagle Iron Works
Pettibone Mulliken Co.

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*Bartlett & Snow Co., C. O.
*Link-Belt Co.
*Robins Conveying Belt Co.

Wire & Cable (Electric)
*American Steel & Wire Co.

Wire Cloth
National Wire Cloth Co.
*Robins Conveying Belt Co.

Wire Rope
*American Steel & Wire Co.
Hazard Wire Rope Co.
Williamsport Wire Rope Co.

Wire-Rope Fittings
*American Steel & Wire Co.
Hazard Wire Rope Co.
Williamsport Wire Rope Co.

Wire Rope Slings
*American Steel & Wire Co.
Hazard Wire Rope Co.
Williamsport Wire Rope Co.

Wire (Welding)
*American Steel & Wire Co.

Worm Gears (See Gears and Pinions)

*** See also information in the 1933 Pit and Quarry HANDBOOK.**

Perforated Metals—Screens of All Kinds—For Sand, Gravel, Stone, Etc.

MATERIAL IN STOCK
PROMPT SHIPMENT

CHICAGO PERFORATING CO.
2435 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

LEADERS SINCE 1835

CRUSHERS—Double roll and Sledge Wedge Crushers, for practically any product. Capacities to 1000 tons an hour.

SUPER DRY PANS—For especially large tonnages.

WASHERS AND SCRUBBERS—Steel log Washers; scrubbers, cylinder washers, sand drags and washing screens.

DRYERS—Revolving cylindrical, of various sizes.

JIGS—For concentrating and beneficiating hematite and manganese ores.

SCREENS—Cylindrical and conical screens of any size and capacity.

HOISTS, ELEVATORS AND CONVEYORS—Electric, friction and gravity hoists, steel conveyors of different sizes and capacities.

McLanahan & Stone Corp.
Hollidaysburg, Pa.

HENDRICK
PERFORATED METALS

are popular in the quarry fields. They wear well. Full range of sizes

Heat-Treated
Double-Corrugated Plates

with square, round and "Sqround" perforations. Write for data, particularly on the new "Sqround" Mesh.

Investigate the Weston Testing Screen for making sizing tests.

HENDRICK MANUFACTURING CO. Carbondale, Pa.

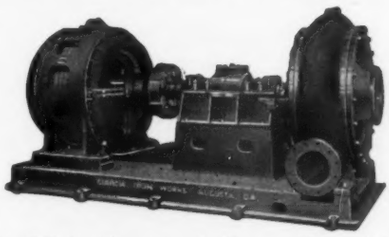
Baltimore Birmingham Boston Cincinnati Cleveland
Detroit Hazleton New York Philadelphia Pittsburgh

EAGLE
EQUIPMENT

Spiral Screw and Log Washers, De-Waterers and Shale Removers, Flume Classifiers, Swintek Ladder Suction Screen Nozzles, Chain Type Cutters, Barges and Pontoons, A Frame and Gantry Hardware, Vibrating and Revolving Screens, Steel Dump Cars, Grizzlies, Car Wheels and Trucks, Steel Bins, Water Tanks, Structural Towers, and Dry Pans.

EAGLE IRON WORKS
Machinists — Founders
DES MOINES, IOWA

SAND AND DREDGING PUMPS



A Wide Range of Sizes, 4" to 14"

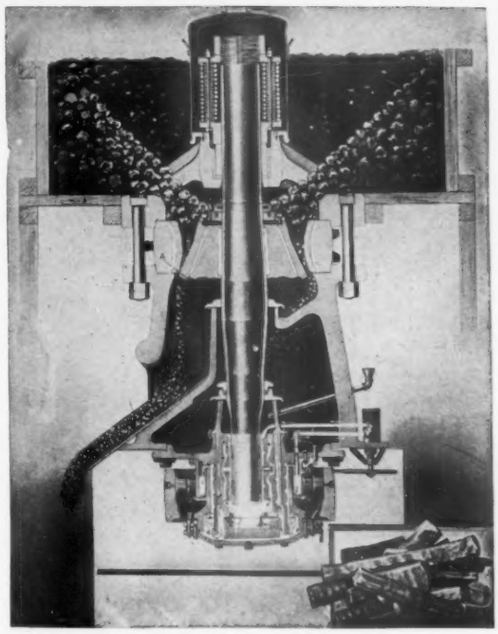
Send for illustrated booklet

GEORGIA IRON WORKS, AUGUSTA, GA.

Lewistown Foundry Products
ARE
Performance-Tested

BUCKET ELEVATORS
REVOLVING SCREENS
CRUSHERS DRY PANS

Lewistown Foundry & Machine Co.
Lewistown, Pa.



Greater tonnage with half the power cost

Guaranteed!

The Kennedy Ball Bearing Gearless Gyratory Crusher is guaranteed to produce a greater tonnage than any other crusher of a given size, with half the power per ton of ore. This crusher can be equipped with a synchronous motor in its pulley, or driven by belt from a standard motor.

The Savings Effected with this crusher are astounding:

In cost of Maintenance.....80%
In Power.....The entire cost of crusher and motor in pulley is amortized annually.

Sieving test on glacial gravel crushed at the rate of 18 tons per hour, with No. 19 crusher set to ⅛ in., and using less than 15 hp., follows:

Minus ⅜ in	100%
Plus 3 mesh	21½%
Minus 3—Plus 4	17%
Minus 4—Plus 14	36½%
Minus 14—Plus 48	15%
Minus 48—Plus 100	4%
Minus 100	5½%

Write today for our Catalog No. 16-P-434

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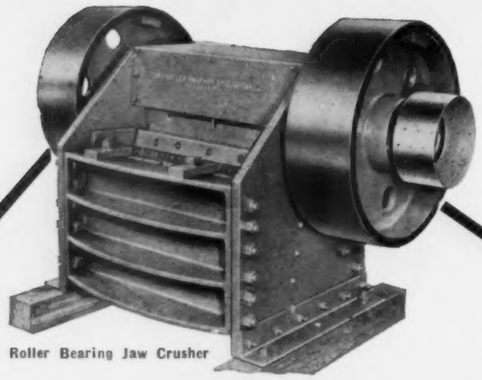

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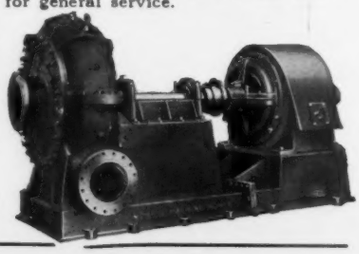

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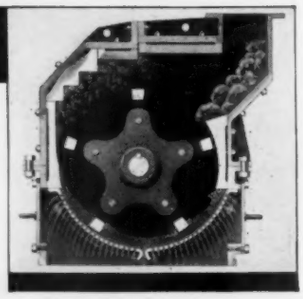

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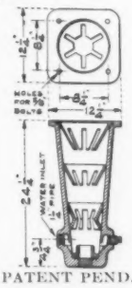

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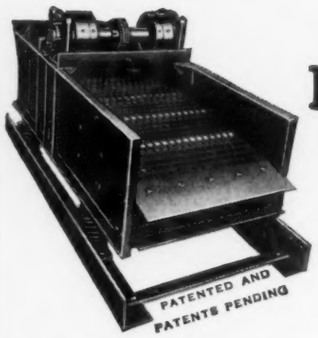

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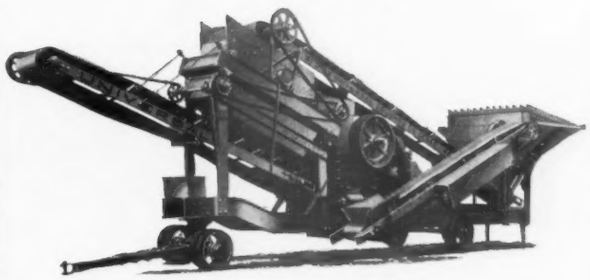

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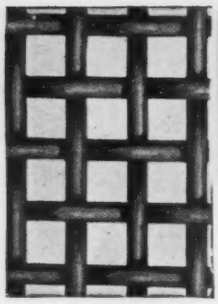

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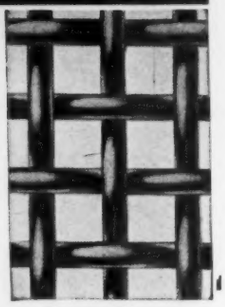

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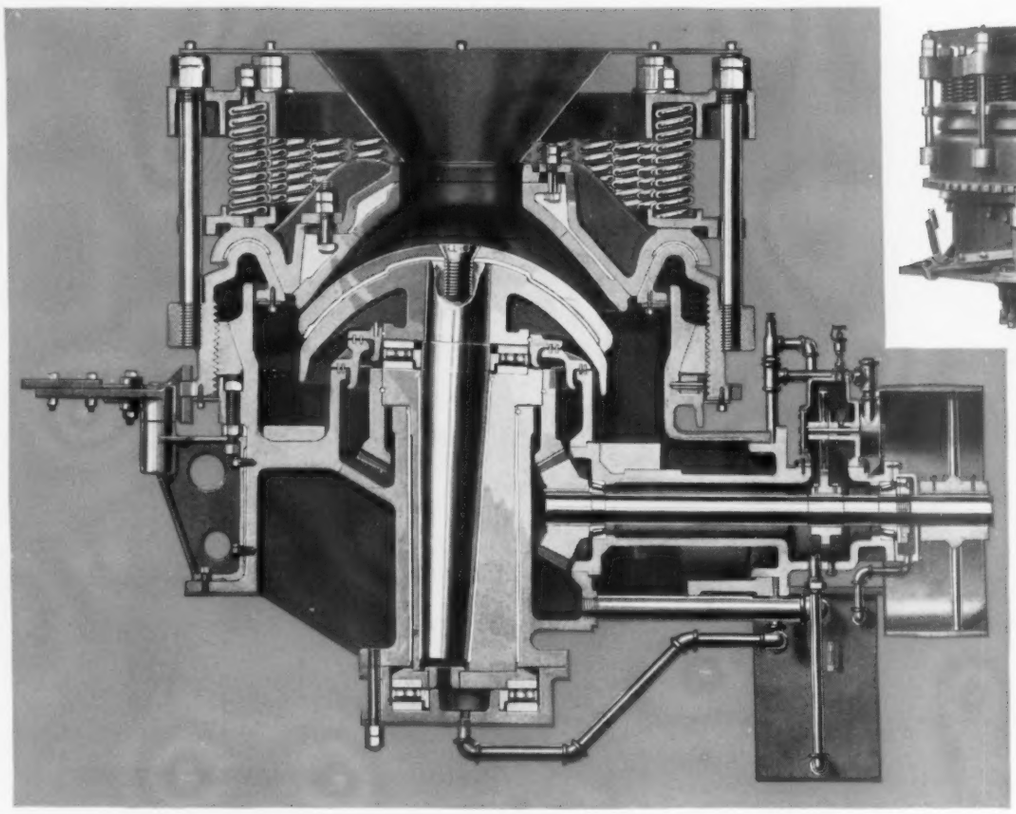
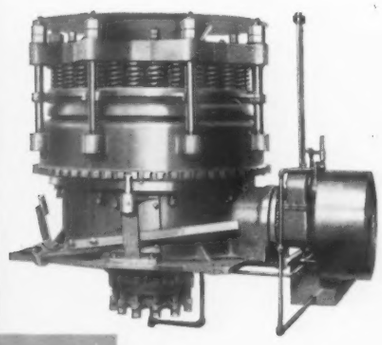
ROLLER THRUST BEARINGS
CHOKE FEED
UNIT SPRING DESIGN





Looks like other spring relief crushers—*but it's different!* Here's a fellow that asks no mercy—expects no "measured feed"—requires no "sparse filling." When the whistle blows, you sock the rock into the hopper—cover it up and pile it deep. Until the whistle blows again, Mr. Gyrasphere is too busy to see callers; but, way down underneath the accumulated rock, there's a crunch—crunch—crunchchch that means steady, reliable, economic, effective, reduction capacity.

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YC-2

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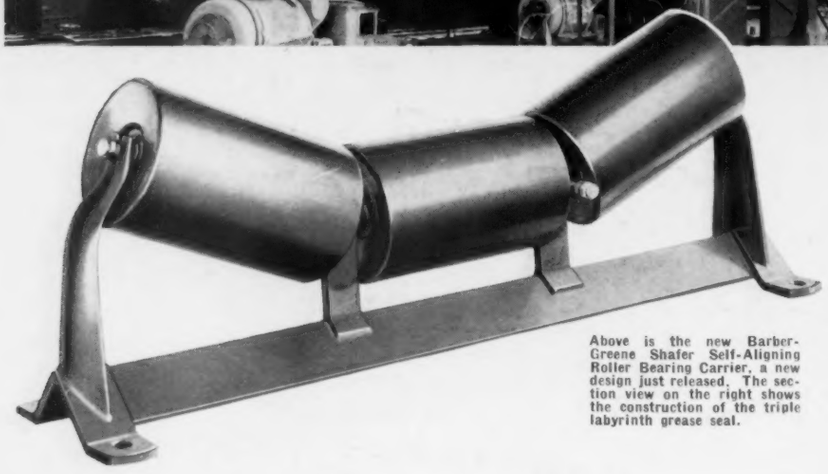
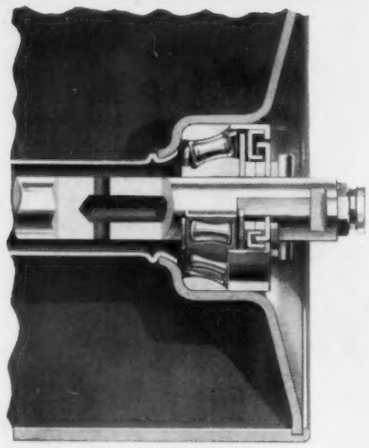
Barber-Greene Conveyors



Above is the new Barber-Greene Shafer Self-Aligning Roller Bearing Carrier, a new design just released. The section view on the right shows the construction of the triple labyrinth grease seal.



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